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Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

April 20, 1932

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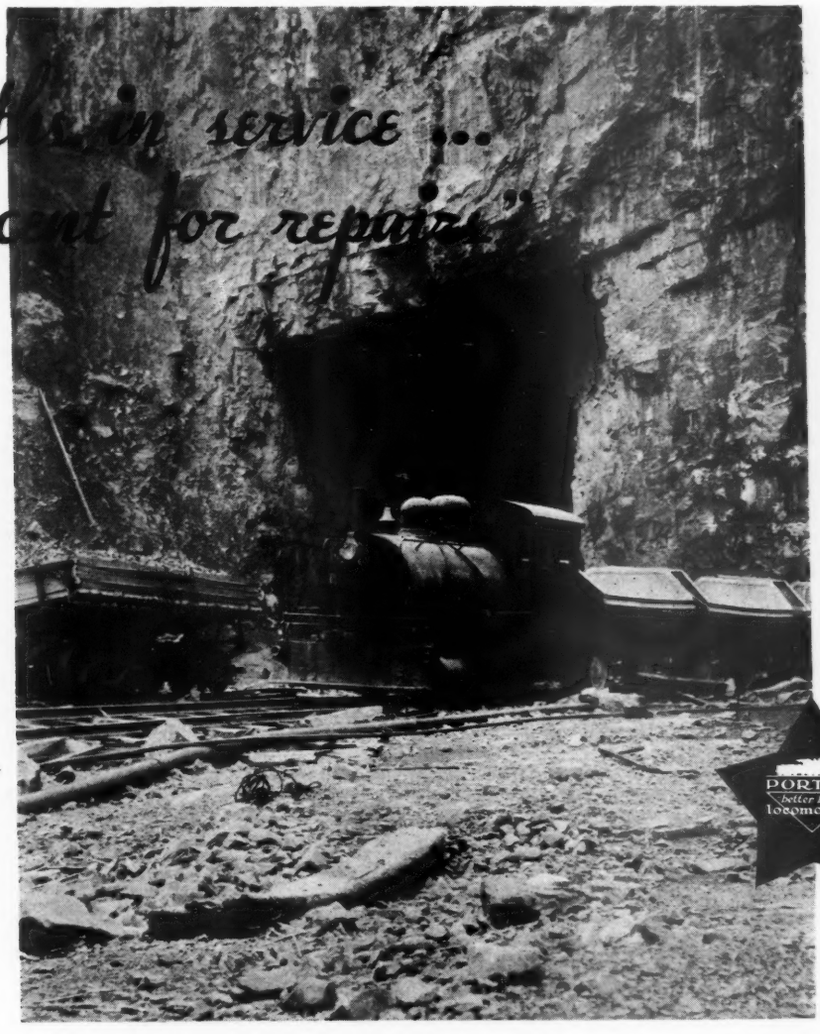

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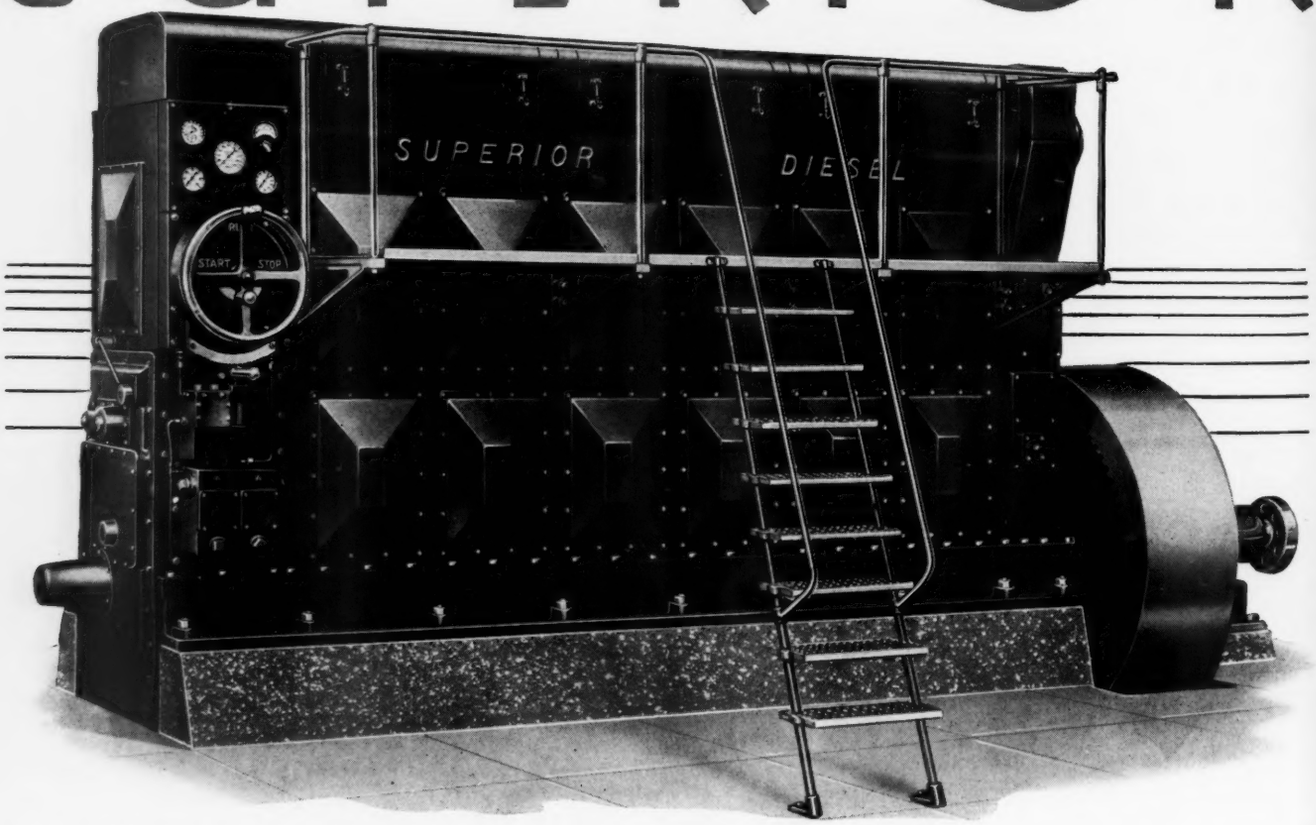

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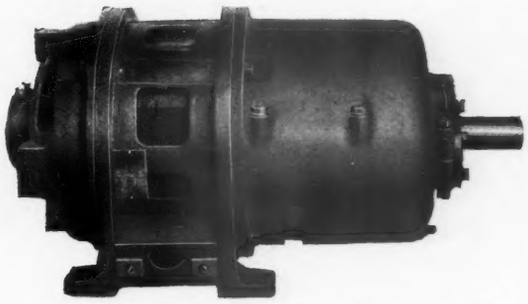
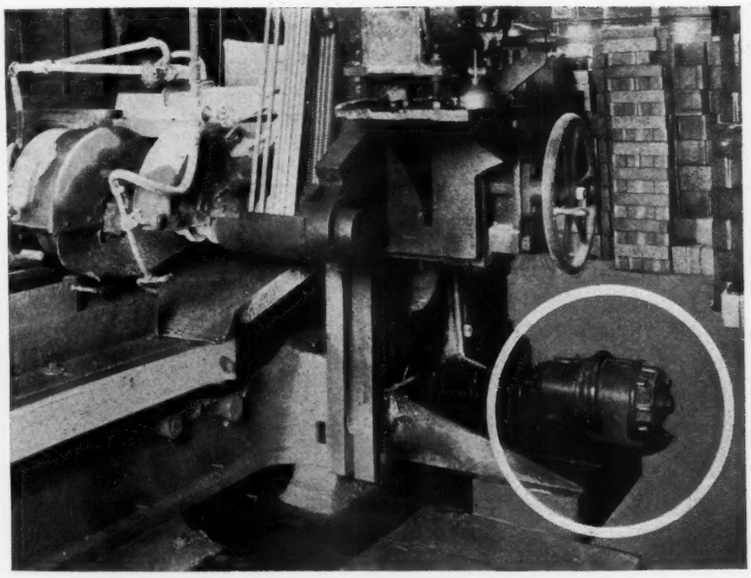


Standard Type D Gearmotor for single speed requirements of 69 to 1550 rpm.



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Pit and Quarry

With which is consolidated
CEMENT-MILL & QUARRY

Volume 24 APRIL 20, 1932 Number 2

MEMBER AUDIT BUREAU OF CIRCULATIONS

Published bi-weekly on Wednesday for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other non-metallic minerals. Entered as second-class matter October 9, 1928, at the Postoffice at Chicago, Ill., under the Act of March 3, 1879.

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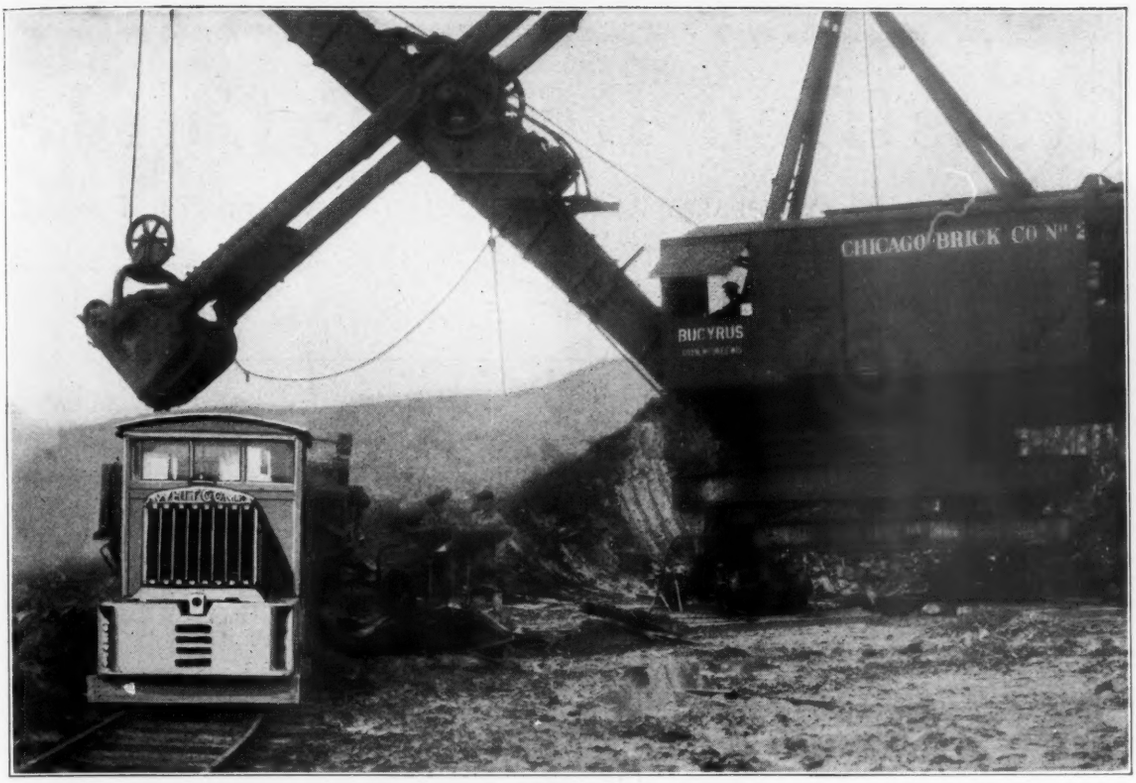

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Whitcomb Locomotives are made for every haulage need, sizes 2 to 100 tons or larger, all gauges, gasoline, storage battery or electric powered.

If your haulage cost is high—if your haulage tools don't make the grade—if you want the lowest cost haulage—*consult a Whitcomb Engineer. They are available at our many branch offices.*

THE WHITCOMB LOCOMOTIVE COMPANY

Rochelle, Illinois

WHITCOMB LOCOMOTIVES

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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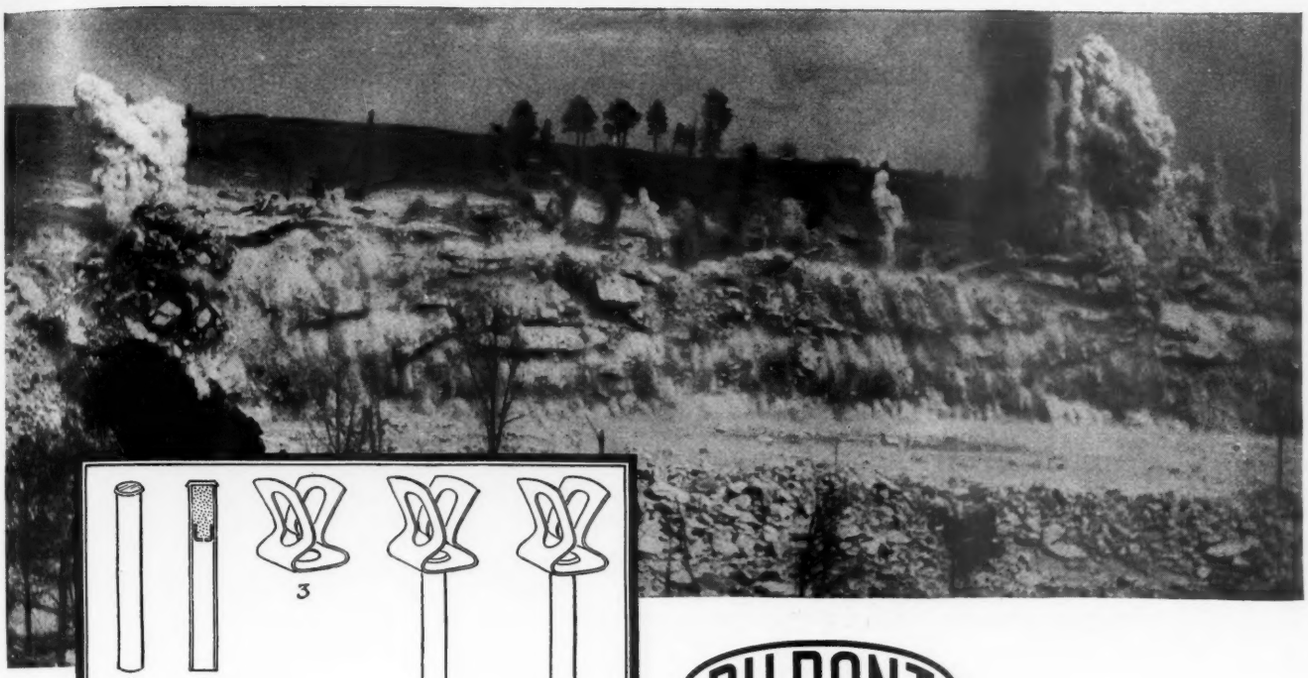

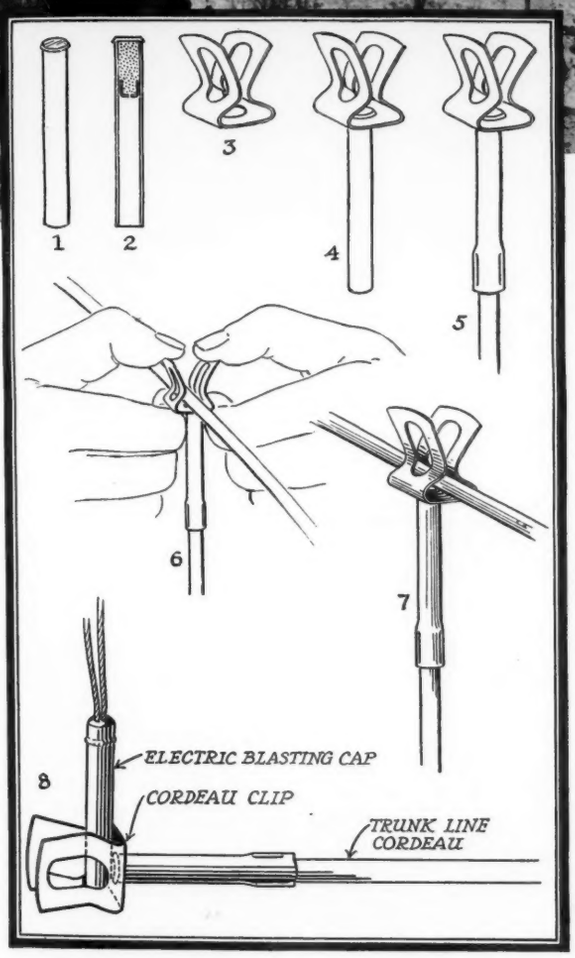

Cordeau Connector Clip and Method of Attachment to Detonator

1. Cap to Be Inserted in Connector.
2. Cross-Section of Detonator.
3. Clip of Cordeau Connector.
4. Detonator Placed in Clip.
5. Clip with Detonator Inserted and Attached to Cordeau.
6. Clip Opened to Permit Inserting Cordeau.
7. Cordeau Connector Holds Cordeau Firmly in Place.

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CORDEAU CONNECTORS

are QUICK, SAFE and EFFECTIVE because they will—

1. **Eliminate Slitting and Winding of Branch Line of Cordeau,—**
2. **Ensure a weather-proof connection,—**
3. **Require only one-quarter of time formerly needed to complete connections,—**
4. **Simplify the blaster's methods,—**
5. **Provide greater assurance of detonation,—**
6. **Aid in firing insensitive charges.**

These Cordeau Connectors are now being used effectively wherever Cordeau Bickford is employed. The simplicity of design, ease of application, and low cost of the Connectors account for the popularity of this newest device in our extensive and efficient line of blasting accessories.

Write for illustrated and descriptive bulletin—"Cordeau Connectors." Learn how they can be used to simplify blasting methods and lower your production costs.

E. I. DU PONT DE NEMOURS & CO., Inc.

Explosives Department . . . . Wilmington, Delaware

Classified Buyers' Guide

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Hardinge Co.
Raymond Bros. Impact Pulverizer Co.

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Hardinge Co.
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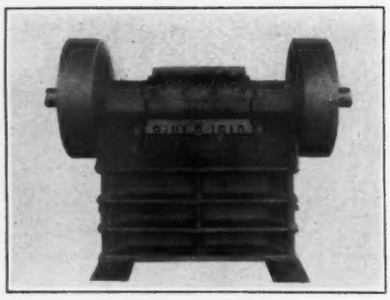
Buffalo Wire Works Co.

Wire-Rope Fittings
Buffalo Wire Works Co.

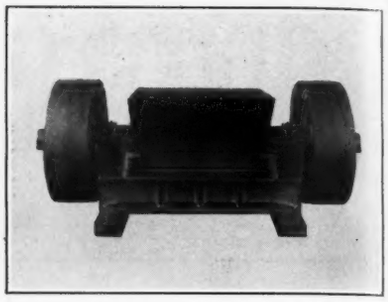
Wire and Cable (Electric)
Buffalo Wire Works Co.

Wire Rope
Buffalo Wire Works Co.

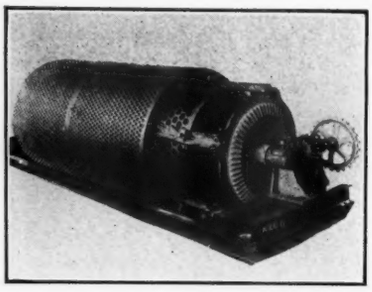
Worm Gears (See Gears and Pinions)



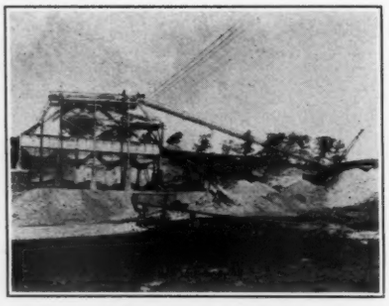
DO YOU know we manufacture equipment for stationary rock, gravel and sand producing plants? Well, we do, and it will pay you to investigate the "Cedar Rapids Line." One of the many important items is the Heavy Duty Trunnion Type Bevel Gear Drive Revolving Screen, such as shown below, and made in a wide range of sizes.



THE 1436 Primary Crusher, pictured above, is built for tough quarry installations. A large, heat treated chrome nickel eccentric shaft, phosphor bronze bearings plus a positive lubrication system and rugged construction throughout, guarantees economical and dependable performance, and dependable performance is important.



THE reduction of quarried rock, uniformly and efficiently, to 3/4" size and smaller, is no problem when you use the CEDAR RAPIDS 336 Heavy Duty Reduction Crusher, pictured above. If you are interested in increased capacity and reduced crusher costs, it will pay you to investigate our 3"x36" Reduction Crusher.



IF YOURS is a conveying problem, let us tell you about Cedar Rapids Belt Conveyors with either plain or anti-friction idlers. They are designed and built for the hardest kind of field work where greater strength and durability are important factors. Pictured below is only one of our many successful field conveyor installations.

AS engineers to the material handling field, we are equipped to design, fabricate and erect complete sand or gravel screening and washing plants similar to the one illustrated above. Send us your inquiry and let us submit you a proposal drawing on a plant to meet your particular requirements.

WE CAN offer you a complete line of vibrator screens, large or small—single, double or triple deck—that will satisfactorily and successfully handle your screening problem. Cedar Rapids equipment will perform to your complete satisfaction. Buy "Cedar Rapids Performance."

» » MATERIAL HANDLING EQUIPMENT « «

Made by

Iowa Manufacturing Company

Cedar Rapids, Iowa

"Performance Is What Counts"

VOLUME 24 NUMBER 2

Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

CHICAGO, APRIL 20, 1932

Lower House Favors Domestic Materials

COMMITTEE REPORT FAVORABLE

Producers particularly those in the Great Lakes area, will be interested to learn that a favorable report has been turned in by committee in the House of Representatives on the bill (H.R. 10743) which would require the purchase of domestic supplies for public use and the use of domestic materials only in public works and building.

The bill provides that "every contract for the construction, alteration, or repair of any public building or works in the United States shall contain a provision that in the performance of the work the contractor and all subcontractors shall, so far as practicable, use only such unmanufactured articles, materials and supplies, as have been mined or produced in the United States, and only such manufactured articles, materials and supplies mined, produced, or manufactured, as the case may be, in the United States."

The provisions of the bill would become operative 60 days after its enactment, but would not apply to any contract entered into prior to such effective date or to any contract that may be entered into after such effective date pursuant to invitations for bids that are outstanding at the date of enactment of the proposal. As the various departmental appropriation bills come before the House, an amendment is added forbidding the use of foreign manufactured or mined articles in the purchases of the department in question; but the purpose of H.R. 10743 is to obviate the necessity of amending every appropriation bill in this manner and, also, to make the prohibition against foreign materials permanent rather than temporary in character.

If the bill is approved, crushed stone, sand and gravel, and other materials produced in the United States must be used in all construction projects, the cost of which is exclusively borne by the Federal government, such as postoffices, etc. But it will not operate in the case of Federal-aid highways, for the reason that the Federal government is not the contracting agent in such cases and, in addition, has no authority to bind the states when they are putting up 50 per cent. of the cost of the road. However, the unmistakable desire of Congress to stop the use of foreign materials, in Federal building projects, at least, offers a suggestion that the states should legislate along the same lines locally.

Utah-Idaho Cement Co. to Dispose of Property

The Utah-Idaho Cement Co. of Ogden, Utah, is offering for sale all its property and assets, real and personal, except money on hand and accounts receivable, free from encumbrances, except the general taxes for the year 1932, and it is announced that written bids accompanied by a certified check for 10 per cent. of the bid, will be publicly opened at the office of the company in the Eccles Building, Ogden.

The announcement was made by a committee representing the board of directors of the company.

Emergency Road Measure Now on Senate Calendar

The emergency highway bill, seeking to appropriate $120,000,000 for highway construction this year to relieve unemployment, which has already been passed by the House of Representatives, has been given a place on the Senate calendar.

Observers have some doubt as to whether it can muster the necessary strength to pass the upper house, however, and there are indications that the bill may die unless strong pressure is brought to bear by those interested in road building.

Volume Index Ready

The volume index covering Vols. 22 and 23 (April 8, 1931, to March 23, 1932, issues) of PIT AND QUARRY is now ready for distribution. As copies will be sent only to those subscribers who write for them, it is suggested that requests be made at once, addressing the Circulation Department.

Edisons to Complete Raritan Cement Mill

ADVANCE $500,000 FOR WORK

Completion and operation of a Portland-cement plant with a capacity of 3,000 bbl. daily on the Raritan River near New Brunswick, N. J., by the reorganized Metropolitan Cement Corp. has definitely been decided upon.

The corporation, originally organized in 1930 and now reincorporated under the laws of New Jersey with Thomas A. Edison, Inc., which also controls the Edison Cement Corp., holding 60 per cent of the stock, has announced that the plant will be ready for operation by the end of the year.

The plant, which was abandoned by the original concern after construction had started, will immediately be rushed to completion, the Edison concern having already advanced $500,000 for this work, the balance to be forthcoming later this year.

The officers of the new concern are practically the same as those of the Edison Cement Corp. Charles Edison is president; W. D. Cloos, vice-president and general manager; Raymond Wetzler, vice-president and sales manager. Ralph H. Allen is also a vice-president and H. F. Miller is treasurer.

Blaze Wipes Out Stone Plant at St. Joseph, Mo.

Fire of unknown origin broke out in the plant of Heumader Quarries, north of St. Joseph, Mo., at midnight, April 6, and destroyed all the buildings and ruined the equipment. The total loss was estimated at $50,000, $24,000 of which was covered by insurance. About $12,000 worth of power equipment alone was ruined.

William Heumader, president of the Company, expects the work of replacing the buildings and equipment to start immediately, but it will be some time before the 50 men regularly employed at the quarry can resume work.

The plant, located high on a hill overlooking the Missouri River from the east, was so arranged that the limestone taken from the strata high on the hill could be delivered to the crushers entirely by gravity.

Refinery By-Product Used in Cement Mill

AID TO PLASTICITY CLAIMED

A recent discovery made by J. M. Evans, research worker, of the Associated Oil Co., and which has just been adopted by one of the large Pacific Coast cement companies, may prove of great value in building construction and afford a market for what has been a waste product in the oil industry, according to the *Los Angeles Times*.

In the manufacture of petroleum products such as gasoline, kerosene and lubricating oils it has been the practice for many years to decolorize these products and purify them by a process known as contact filtration. In this process a chemically reactive clay is usually ground to the fineness of flour and mixed with the oil at elevated temperatures. The clay is then filtered out of the oil and carries with it the resinous bodies which have caused the dark color. This clay, after use, was a waste product at the refinery and it was difficult to dispose of. It was used to pack around pipe lines to prevent corrosion or to lay a base under steel tanks giving a waterproof foundation. However, a great deal of it had to be dumped and the expense of disposal was often quite a sum to be charged against the finished petroleum product.

Mr. Evans' discovery has shown that a small percentage of this clay, in the neighborhood of 3 to 5 per cent, will greatly improve Portland cement. The spent clay is ground into the raw mix at the time of manufacture and is said to produce a Portland cement having greater plasticity as well as waterproof properties and increased strength. The plasticity makes it possible to spread more easily and get a smoother finish. The water-proofing quality may be valuable in stucco work, in foundations and under any conditions of moisture.

Move Dredge Down River to Fill Road Contracts

The Missouri River Sand & Gravel Co. has moved its steamer *Dixie*, a sand dredge and two barges from Boonville, Mo., to Northrup, Mo., where sand and gravel will be produced. The firm has a contract for supplying 25,000 tons of material for highway construction work in that vicinity.

A crew of seven men will be employed for a period of 60 days in fulfilling the contract.

Gravel Business Again Calls Bruce D. Maxwell

Bruce D. Maxwell, formerly owner of the Maxwell Gravel Co. of Indianapolis, Ind., has purchased a half-interest in the Fall Creek Gravel Co., also of Indianapolis, and is "back in harness" again. The Maxwell concern, one of the pioneer producers in the Hoosier capital, was sold to the American Aggregates Corp., of Greenville, O., more than a year ago. The Fall Creek organization was formed in 1929 by John Hessong and Wallace Mains and it was the interest of the latter that Mr. Maxwell has acquired.

In associating with the Fall Creek company, Mr. Maxwell becomes president of the firm, while Mr. Hessong remains vice-president and treasurer.

Eliminate Objectionable Features of River Bill

Senate Bill 1963, which proposed that producers of materials on waterways be prohibited from transporting their own materials has been revised to eliminate inland lakes and streams and now applies only to intercoastal commerce.

So many objections came from operators the country over that Senator Hiram Johnson, its sponsor, withdrew it in its original form at the request of the U. S. Shipping Board, which really sought its adoption.

The bill's penalties were so severe that many river producers of sand and gravel would have been forced out of business had it been adopted. The National Sand & Gravel Assn., at its recent convention in Pittsburgh adopted a resolution of protest against the provisions of the measure.

Superior Portland Steps Up Production Schedule

The cement plant being operated by Superior Portland Cement, Inc., at Seattle, Wash., went on an increased production scale recently following a period of comparative idleness. Seventy-five former employees were hired.

The finish-grinding departments at the company's main operations at Concrete, Wash., have been operating fairly steady throughout the past few months and firing of the kilns is expected to be resumed there shortly.

Dubuque Gravel Concern Buys Stone Products Co.

According to an announcement by Bart Molo of the Molo Sand & Gravel Co., Dubuque, Ia., the sand-and-gravel business of the Dubuque Stone Products Co. has been bought by the Molo firm. The purchase includes the Mississippi River yards of the company, floating equipment consisting of five barges and dredge, and the good-will and business.

Land Corporation Opens New Quarry in Missouri

The Todd Land Corp. of Webb City, Mo., has opened a stone quarry four miles east of Neosho, Mo., where crushed stone will be turned out for highway purposes, and lime dust for agricultural use.

Free Dredging Right in Lake Erie Denied

GOV. ROOSEVELT VETOES BILL

Gov. Franklin D. Roosevelt of New York, has vetoed a bill recently passed by the state legislature, sponsored by Sen. W. J. Hickey, Buffalo, to permit the removal of sand and gravel from the bed of Lake Erie. The measure was designed to permit such operations without compensation to the state, and private dredging operators would have given employment to about 500 men, it was stated, if the activities had been legalized.

The governor held that such commercial operations on state-owned lands under water should be of statewide character and not apply solely to the district noted, and furthermore, should provide adequate compensation to the state.

Kosmos Portland Lands Highway Cement Award

The Indiana Highway Commission has let contracts for 92 miles of pavement to cost approximately $1,000,000. Eleven contracts were let, the largest, for $326,401.28, going to Louis des Cognets & Company, of Lexington.

About 30,000 bbl. of cement, to be delivered through the Mead-Johnson Terminal, Evansville, have been purchased by the Commission for the des Cognets contract from the Kosmos Portland Cement Co.

Acquires Gravel Dredge; to Operate on Allegheny

Following the recent purchase of the sand-and-gravel dredge, known as *The No. 6*, from the McClain Sand Co., Point Marion, Pa., the Hudson Sand Co., Kittanning, Pa., is planning to place the unit in service in the upper pools of the Allegheny River at an early date. Large output is planned and facilities will be provided to handle the production. With slack water now existing for a distance of about 60 miles along the river, it is expected that the coming season will see a large increase in dredging operations in the upper pools of the stream.

Another Danish Cement Plant Ceded to Smidth

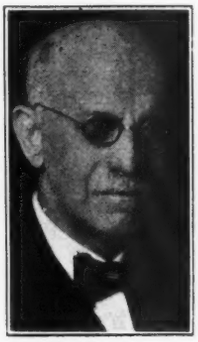
The Nrresundby Portland-cement plant in Denmark has been ceded to F. L. Smidth & Co., Ltd., and the company is now reported to be the owner of all producing plants in that country with the exception of the Danish Coöperative.

The Nrresundby operation has a yearly capacity of 900,000 bbl. It was originally built to provide cargo for the ships of the East Asiatic Co.

Pioneer in Lime and Cement Field Passes

E. S. HEALEY, AGE 73, DEAD

E. S. Healey, president of the Glencoe Lime & Cement Co., manufacturers and jobbers at St. Louis, Mo., and one of the well-known figures in the lime industry for many years, died at his home in Webster Groves, a St. Louis suburb, recently. He was 73 years old and death was due to acute indigestion. He had been in apparently good health until he was stricken, having been at his desk at the office of his company the preceding day.



E. S. Healey.

Mr. Healey came to St. Louis in 1889 from Rockland, Me. Before engaging in the lime business he was connected with the Hurricane Island Granite Co. of Maine. His early association in the lime industry was with the late Col. C. W. S. Cobb, who headed the Glencoe Lime & Cement Co. until his death in 1928. Since 1928, Mr. Healey had been its president, having formerly served as secretary and treasurer.

He was a director of the National Lime Assn. for many years and was active in the formation and affairs of the St. Louis Building Material Dealers' Assn., having served as its president, on the board of directors, and as trustee. During the last decade he was also president of the Webster Groves Trust Co.

In the early years of its existence, the Glencoe Lime & Cement Co. acted as agents for some of the first cement producers, among them being the Lehigh Portland Cement Co. and the Sandusky Portland Cement Co. After the Lehigh company built its plant near St. Louis the company, through close contacts maintained by Mr. Healey, continued to represent them in the St. Louis territory.

To Supply 25,000 Cu.Yd. of Sand for Ferry Dock

The Nugent Sand Co. of Muskegon, Mich., has started work on a huge fill at the new car-ferry dock soon to be constructed at Muskegon. About 25,000 cu.yd. of sand will be loaded and shipped by rail to the site of the dock.

$25,000 Spent on Plant by Minnesota Producer

More than $25,000 has been expended by the Zenith Concrete Gravel Co., of Carlton, Minn., in making major improvements at its plant this spring, according to H. H. Kelly, manager. A new Symons cone crusher was purchased, while the Gates and Austin crushers formerly operated were rebuilt. New screening equipment and chain drives were purchased from the Link-Belt Co., new Westinghouse motors were installed. Worthington pumps and considerable Tyler screen cloth were also used in improving the operation.

Brings Cheery News to Cement-Plant Workers

More than 200 employees and guests of the Lawrence Portland Cement Co. plant at Thomaston, Me., attended the annual safety banquet held recently. Frank A. Smith, president, journeyed to Rockland from his home in New Jersey particularly to attend the gathering and added an encouraging note of cheer in his talk when he assured the workers that all kilns would be in operation this month, that the present scale of wages would be continued and that no reduction of the operating force was contemplated.

Carl H. Sonntag, plant superintendent, arranged for the gathering.

High-Silica Cement for Plastic Work Perfected

Perfection of a new cement for plastering purposes containing a high silica content has been announced by the Santa Cruz Portland Cement Co. The cement, which is being produced at the company's plant at Davenport, Cal., is quick drying and has received a ready acceptance from the trade in the short time it has been on the market for trial, according to Fred Davis, superintendent.

Additional equipment will be installed to handle future production of the new product, it is reported.

U. S. Gypsum Co. Plant to Produce Paper Bags

After having been closed for two years, the United States Gypsum Co. has announced that its plant at Lancaster, O., is to be reopened. Gypsum board was formerly produced there, but paper bags for the shipment of the company's products will be made in the future, according to C. E. Radley, superintendent.

New equipment to allow the manufacture of sacks is now being installed.

Batching Plant Planned by Iowa Gravel Concern

The Camanche Sand & Gravel Co., Camanche, Ia., has secured a location for the erection of a batching plant which will be used by the firm in proportioning sand and gravel for concrete, the aggregate being produced from its Mississippi River operation. Construction work will be started at once.

White Cement Being Produced in Mexico

MONTERREY PLANT ADDS UNIT

Until very recently all the White Portland cement consumed in Mexico was imported from the United States or France. Because of the excessive cost to the consumer, due to long transportation, customs duties and handling charges, general use of this important building material has been very limited, the annual consumption being only about 10,000 bbl. The demand is too low to justify the installation of a plant dedicated exclusively to the manufacture of this product.

Recently, after making an extensive study of the available raw materials, Cementos Mexicanos, S. A. of Monterrey has installed additional equipment at its Monterrey plant, according to H. E. Leach, superintendent, so arranged and adapted to the original installation that it may be utilized in the production of white Portland cement or for increasing the production of its standard brands of Portland cement to suit the market demands. The new unit utilized in the production of white Portland cement has a daily capacity of 600 bbl. of "Monterrey Blanco" (White Portland) or 900 bbl. of standard Portland cement.

The raw materials were carefully tested and extensive experiments made at the Monterrey plant, which results were checked by consulting testing laboratories in the United States, prior to the installation of the new equipment, and the materials were found to be exceptionally well suited for the manufacture of a strictly high-grade white Portland cement.

This company started production of "Monterrey Blanco" Portland cement in December, 1931, and this product has been very well received on the market, comparing very favorably in color and quality with any of the best imported brands of white cement.

The following laboratory reports will doubtless be of interest:

Chemical Analysis

SiO_2	24.20%
Al_2O_3	6.92
Fe_2O_3	.38
CaO	66.45
MgO	.50
SO_3	1.98

Tensile Strength (1:3 mortar)

Steam test	Excellent
Initial set	2 hr. 30 min.
Final set	4 hr. 30 min.
Material passing 200-mesh	95.04%
Material passing 325-mesh	82.93%
Normal consistency—neat	24.00% water
Normal consistency—sand	10.50% water
1 day	234 lb. per sq. in.
3 days	293 lb. per sq. in.
7 days	329 lb. per sq. in.
28 days	416 lb. per sq. in.
60 days	496 lb. per sq. in.

The North American Gypsum Co., Ltd., is reported preparing plans for a plant to cost about $150,000 to be located at Baddock, Nova Scotia.

Editorial

Industrial Birth Control

WHENEVER one suggests the application of some means for preventing the unchecked expansion of business, the wasteful duplication of producers in all lines of industry, he is commonly greeted with the sneers of those who delight in pointing to the Edisons and the Fords as shining examples of the great advantages that inhere in our system of encouraging initiative in whatever direction it may seek its outlet. What, these men ask us, would have become of us if Edison had been prohibited from manufacturing his incandescent lamp or Ford from making his "universal" car? What if Pullman had not been allowed to give us the modern sleeping car and if Westinghouse had not been permitted to make air-brakes? Where would modern business be if these great inventors had not given us the fruit of their minds and the products of their factories?

Unfortunately these questions do not touch the heart of the matter, pointed as they may seem. No one of serious mind has, as far as we know, advocated the suppression of inventive talent and, judging by the clutter of applications and grants in the United States Patent Office, the inventors of the country have not been affected to any great degree by restraining influences of any kind. American inventors have probably produced more inventions and brought fewer of them to the production stage than the inventors of all other nationalities combined. Such a situation could not have developed if inventors had felt any other restraining influence beyond the common difficulty of raising the necessary government and solicitors' fees.

Those who argue for some practical check on the American prerogative of "rushing in where angels fear to tread," when it comes to embarking on some form of business enterprise, certainly do not favor placing restraints on the Fords and Edisons. In relation to our population and the number of persons engaged in business we produce a lamentably small number of Edisons and Fords, and no one who places a proper appraisal on their efforts could possibly oppose the encouragement of their type of talent and ability. Those who plead for the control of business enterprise, by regulating the number of those who undertake the risks of new ventures, seek to improve business conditions, not to make them worse; they would better the situation of those already in business by preventing the unwarranted entry into it of newcomers who are unfit either to contribute anything new or even to carry on without making any valuable contribution.

The fact of the matter is that the great majority of those who enter business—and it makes little difference what business one has in mind—make no valuable contribution to the field they enter. They bring no new inventions, they make no better products, they offer no improved production methods, they do not reduce the cost to the consumer (except in times of business stress and then they lower prices below the cost of production), they do not elevate the business standards of their industry. In fact, they contribute nothing but added competition, added confusion, added disappointment. They divert capital from more useful purposes to the development of new enterprises in industries which do not need them, and then by disappointing the investors who have made their folly possible they make it more difficult for necessary enterprises to finance warranted improvements and expansion. The economic waste of this unbridled play of individual initiative, the actual money cost of the terrible duplication and industrial demoralization that result, is incalculable.

In a country where the theory of individualism is so generally accepted that every boy considers himself presidential timber, where nearly every man feels that every field is open to him regardless of his experience, training, or natural fitness and that he has the right to experiment in it and risk the capital of others while endangering the safety of existing enterprises, where self-interest and not the general welfare is the test of the rightness or wrongness of his projected venture—under such circumstances it is not easy to find support for the principle of industrial birth control among those who look longingly and hungrily from one business to another, seeking the one which seems to offer the best promise of rapid personal reward. But men who are already established in business recognize the need for such restraint, not alone because they yearn for the protection which such control would aid in providing, but because many of them realize from bitter experience the folly of doing what the average newcomer plans to do.

We hold no brief for the established order or established businesses simply because they are established, because every established industry already exhibits the sorry conditions which industrial birth-control advocates seek to correct. The average of intelligence, or understanding, or consideration for effects was certainly no higher among those who entered business fifty, twenty-five, or even five years ago than it is among those who clamor for admission to the ranks of industry to-day and, unless industrial birth control gains adherents and becomes a reality instead of a theory, that average

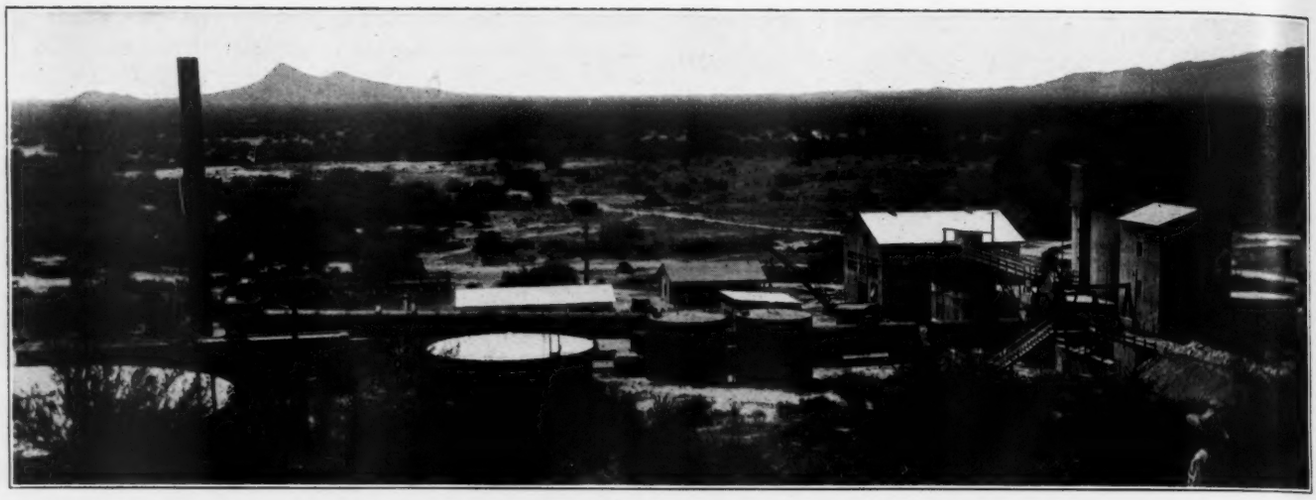
will be no higher in the years to come. One is not likely to surrender voluntarily the normal ambition of self-betterment or to direct it along safe channels simply because the prospect of failure stares him in the face or as long as the consequences of his folly do not threaten to penalize him until some remote future date.

But many of those who believe in the principle of industrial birth control hesitate to urge its adoption because of their fear that it in some way violates a natural right of the individual, although there are enough parallels in other forms of activity which they accept without objection. If a state can check or stop the entrance of foreigners, why can not an industry check or stop the entrance of newcomers? If a nation made up largely of persons of foreign birth has the right to prohibit the admission of more of their own kind—if, having enjoyed the advantages of a policy that admitted them, they then turn about and deny those advantages to their would-be successors—shall not an industry made up of those who entered it free from restraints be privileged arbitrarily to set up a system of restraints upon those who would follow them? If a state with an eye to the common good of its members can restrict the practice of medicine, the erection of buildings, the supply of electricity, and the like to those who have demonstrated their fitness to perform such services and then impose regulations controlling the technique of such services and the cost at which they can be performed, can not the permission to produce shoes, food, nonmetallic minerals and the like be similarly restricted and regulated by the industries which produce them if such control will be for the common good of its members? And, to carry the analogy a step farther, if a state has the right to control the manufacture of noxious drugs in order to prevent the individual from injuring himself physically and mentally and if it may legally provide unemployment or old-age insurance to protect him economically, might not its paternalistic solicitude be widened to include means to prevent him from injuring himself financially? And if all this is done on the theory that other members of society need protection against the consequences of his unwise actions, can not the same theory justify a similar restraint of his speculative ambitions on account of what amounts almost to a certainty that these ambitions will injure other business men? If society is anxious to keep a man out of jail and the insane asylum, should it not be equally concerned about keeping him out of the poor-house?

There is nothing new about this principle of industrial birth control. Men have thought about it and talked about it for years, even when economic conditions tolerated and perhaps sometimes smiled upon the foolish business adventurer. But now conditions are different, and in all lines of industry business men are seriously considering what could and should be done to protect not only the horde of investors whose capital is already invested (either wisely or unwisely) in existing businesses, but also the men who are employed in those enterprises, and the capital of those who are and will be asked to invest in new enterprises. Even in good times there was a growing suspicion that the saturation-point in the expansion of industry had been reached; to-day the feeling has become a certainty. This does not mean that industry can never more expand, but that it has reached the point where its production facilities are equal to the demands of the market and that the latter must undergo some expansion on their own account before any further expansion in production facilities will be justified.

Nearly everyone is prepared to admit that the industrial garden needs weeding. During the last two years the ravages of the wild growths have all but destroyed even the hardiest plants, and although there is insufficient nutriment to support all there is plenty for the weeds and they display a peculiar aptitude for getting what they need for their slender existence. The trained planter does not deliberately set out noxious weeds that will endanger or destroy his crop. Neither does he wait for them to grow naturally but instead uses means for preventing their appearance. Should the plots of industry be less wisely cared for? Would not it be sensible to prevent the birth of dangerous industrial enterprises instead of allowing them to germinate and then trying to weed them out? Those who shrink from the thought of destroying some established enterprises in order to improve the profit-making possibilities of those that are left—just as they would recoil from the prospect of destroying the lives of social undesirables to make life easier for those who remain—should not hesitate to approve measures that would prevent the birth of unfit and industrially unnecessary enterprises any more than they would pause at the adoption of means to prevent the birth of unfit and socially useless individuals.

This is the trend of modern thinking on the subject of industrial regulation and it makes little difference to most advocates of industrial birth control whether the restraints are imposed by trade associations or by government as long as the policing is effectively and honestly done. Most of the suggestions for modification of existing anti-trust legislation spring from the feeling that the evil must be attacked at the root—that is to say, at the very genesis of the industrial unfits and misfits—yet they are not likely to be very effective because they do not recognize or utilize the principle that the preventive for overcrowding and overexpansion in industry must be applied before new enterprises are launched and not after they have taken root and done their damage. Relief lies in prevention, not cure.



A view of the entire plant. Kiln, stack and slurry tanks at left. At the right is the crushing and grinding department and the cement-storage silos and pack-house.

New Cement Mill on Sonora River Serves Mexico's West-Coast Territory

CEMENT is now being produced and marketed on the West Coast of Mexico by the Cemento Portland Nacional, S. A., Hermosillo, Sonora, Mexico. The new wet-process plant completed a short time ago is located on the banks of Sonora River adjacent to a deposit having millions of tons of high-quality materials, both limestone and shale, at the edge of which lies an inexhaustible supply of clay, also of high quality.

The plant was originally designed to manufacture a minimum of 250 bbl. per day but, as the machinery installed, due to the characteristics of the materials, is capable of producing a much larger quantity, it will be possible to take care of the present consumption in the territory served by alternating the use of the various units with a small production organization and as the consumption increases it will be possible to produce approximately 500 bbl. per day by operating all the major equipment 24 hr.

The quarry lies 700 ft. from the plant and is opened at an elevation which allows the side-dump quarry cars to travel by gravity to the crushers. They are returned to the quarry by burros, these being a power force quite plentiful in Mexico which proves very efficient in this instance.

Hands across the border. Arthur Brisbane (left) famous newspaper writer, wishing President Francisco S. Elias success for the new industry.

The stone is dumped directly into a 12 in. Traylor gyratory crusher, which delivers it to a bucket-elevator discharging to a 4½ Traylor gyratory finishing crusher. Thence it passes by elevator to a cylindrical mill-feed bin having a capacity of 50 tons of crushed material. Arrangements have been made so that the crushed material may be loaded direct to railroad cars for commercial shipments.

The characteristics of the limestone being used are such that it is highly crystalline in quality and very easily crushed. After it passes the larger crusher, very little work is necessary by the smaller unit, and the finished feed to the mill is of an ideal size for easy and efficient grinding.

The stone is fed to the mill with the proportionate amount of clay, which has been pumped to a supply tank above the mill and will be discussed later. The wet-grinding mill is a 6 ft. by 22 ft. Traylor two-compartment ball-mill, driven by a 300-hp. motor through a 300-hp. speed-reducer.

The slurry is discharged from the mill to a tank or receiving hopper, having a capacity of approximately 50 bbl. The contents of this tank are constantly agitated by exhaust air, piped from the Diesel power-plant. By installing this tank at the end of the raw-

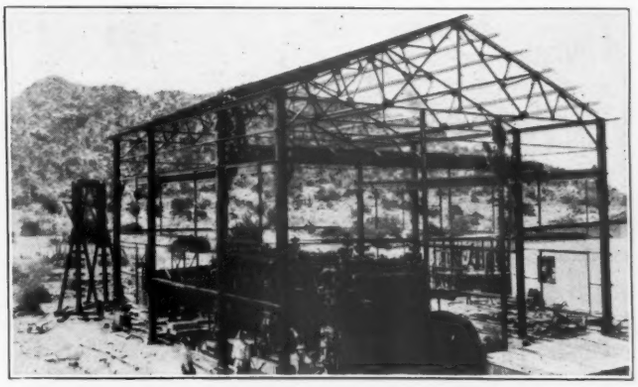
grinding mill, it was possible to install a larger and more efficient slurry-pump which operates intermittently as the tank becomes loaded. The slurry from this tank is pumped by a 2 in. Wilfley slurry-pump to any one of the four concrete slurry-tanks, which are 14 ft. in diameter and 21 ft. high. Agitation of the slurry is done with air furnished by a 12 in. by 9 in. Worthington horizontal compressor. Other Wilfley slurry-pumps are so arranged that slurry can be transferred from one tank to another for blending, or to the kiln, as desired.

The clay used in the mix is transported a short distance to the plant by 2-wheel carts. It is then put into a receiving hopper, which has an exact measured capacity, and is fed from this hopper to a belt-conveyor, which delivers it to a duplex stepless blunger, made by the Crossley Machine Co.

The clay is very fine in quality, being similar to

View from quarry looking toward the plant. The difference in elevation allows loaded cars to move by gravity.

diatomaceous earth, and is readily broken down. From the clay-mixing machine the clay is drawn off into either one of two shallow concrete tanks, where any roots or floating foreign material is removed and where stones and a percentage of free silica particles are deposited. The filling of these tanks is alternated, which allows a period of time for settling before the loaded tank is emptied. The clay is drawn off at 1 ft. above the bottom of the tanks and that portion below the draw-off is cleaned out occa-



Power-house under construction, showing the three Diesel engines in place.

sionally and wasted. Clay from the small tanks is pumped to one of two larger concrete clay-storage tanks and from these it passes to the supply tank over the raw-grinding mill, or direct to the slurry-tanks, as may be the desire of the plant operator or chemist. Corrected material is pumped to a Ferris-wheel type feeder as required; this feeder delivering the slurry to an 8 ft. by 150 ft. single-roller support Traylor kiln, which is lined with fire-brick furnished by the General Refractories Co.

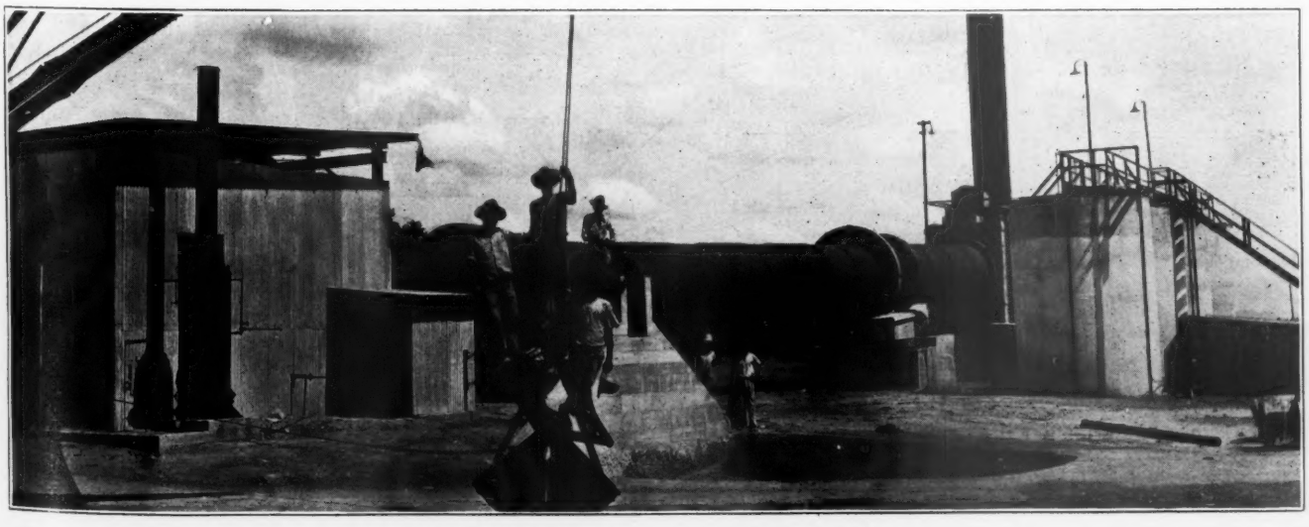
The clinker from the kiln is discharged to a clinker drag-chain which deposits it over a concrete retaining wall into storage.

The fuel oil for the kiln is heated and pumped to the kiln burners by a twin fuel-oil set equipped with an oil-heater furnished by the Buffalo Steam Pump Co.

The air for the kiln is furnished by a No. 44 Buffalo Forge Blower, delivering 1,400 cu. ft. per min.

The clinker is stock-piled and delivered, as required, to an elevator which fills the 50 ton bin over a 6-ft. by 22-ft. Traylor finish-grinding mill by a P & H ¾-cu. yd. gasoline crane. It is necessary to operate this crane only a few hours each day to take care of the present plant capacity.

A small elevator delivers the gypsum to an overhead bin, from which it is fed to the mill by a table-feeder. From the finish-grinding mill the cement is delivered by a screw-conveyor and an elevator to



A view of the kiln with the slurry-tanks at the right.

the storage-silos. The present storage installation consists of two concrete bins, having a capacity of 2,500 bbl. It is intended that additional storage-silos will be constructed in the near future and provisions have been made for this addition.

Cement from the silos is delivered to the Bates two-tube packing machine by conveyors and elevators. The packing plant is so designed that deliveries can be made to either trucks or railroad cars, as both types of transportation will be used. The plant is located on the main line of the Southern Pacific of Mexico and switching and transportation service is available as promptly as necessary by the cement company.

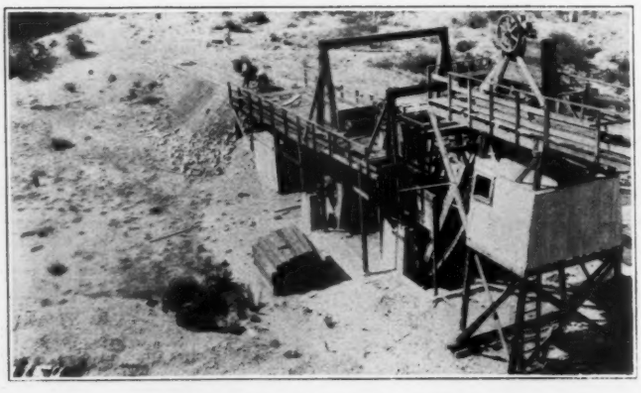
The electric power for the operation of the plant is generated by three Diesel engines, furnished by the Worthington Co., through Westinghouse generators. The engines are 360 h.p. each, direct-connected to 312-k.v.a. Westinghouse 2,300-v., 3-phase, 60-cycle generators. These furnish a surplus of power, allowing one engine to be used as a stand-by at all times, except when it is necessary to start the second 300 h.p. motor on one of the mills, at which

Looking down into the slurry and clay-storage tanks.

time the third engine is started to take care of the heavy starting pull of the large motor, after which it is shut down until needed again.

The 26-gravity fuel oil for the Diesel engines and the 14-gravity oil used in the kiln are being furnished by the Standard Oil Co. They are hauled by rail from storage-tanks at Guymas, the nearest seaport.

The screw-conveyors, elevators and all transmis-



Close view of the crushing plant.

Drag-chain for clinker at discharge end of kiln in foreground. Bins, storage silos and pack-house in rear.

sion machinery was furnished through the San Francisco factory of the Link-Belt Co. All crushers, grinding mills, kiln and feeders were furnished by the Traylor Engineering & Mfg. Co. Electric motors and all electric supplies were furnished by the Westinghouse Electric & Mfg. Co. The Diesel engines, air-compressors and water-pumps were furnished by the Worthington Co.

The design and engineering for the entire plant were carried on in the San Francisco office of the

Clinker and stone-storage bins. Crushing plant at right.

Macdonald Engineering Company, under the supervision of E. F. Raeside, vice-president, and C. L. Carman, chief engineer. The field work and construction of the plant were carried on by the same company under the supervision of W. M. Reynolds.

The management of the plant is under the direction of F. G. Elias of Hermosillo. J. G. Dean of Los Angeles is superintendent and chief chemist for the cement company in charge of production.

WISCONSIN'S state geologist, E. F. Bean, has written an informative article on the state's nonmetallic-minerals which appears in this issue. **Turn to page 42.**

What the Construction Industry Can Do to Restore Public Confidence*

By WILLARD T. CHEVALIER

Director, Civil Engineering Publications
McGraw-Hill Publishing Co.

PRESENT business conditions have given rise to three types of convention speakers. There are the Pollyanna type and the "Woe-is-me-all-is-lost" type, but worse than these is the panacea-hawker, the boy that has the remedy and is going to set it all straight. I hope you will not classify me under any one of those three categories.

I come not as one who knows a great deal about the sand-and-gravel business, not as one who can tell how to set it right, but simply as an observer from the sidelines who will try to appraise the present conditions, see what justification there may be for them, and determine what influences there may be at work to remedy them. Some of those influences may be within our own control; many of them are not.

The General Business Picture

First, let us take a broad view of what we see in the business world about us. The first fact that impresses us is a world in debt; and if I were asked to write the complete story of the present situation in one word, I should write that one word, d-e-b-t. The second fact that strikes us is a tremendous volume of deferred buying, of unsatisfied wants, of potential demand. The third is a very low price level. Another is a vast unused fund of credit and cash resources. Still another is a wholesale and extreme deflation of values. We are just as much overdeflated to-day as we were overinflated in 1929.

Not long ago a manufacturer showed me that the public appraisal of his business, as determined by the market value of his outstanding securities was no greater than the value of his liquid assets. He received no credit for his plant, or his value as a going concern. Of course such overdeflation aggravates the first item that I mentioned, because, after all, the burden of debt is relative. As the public appraisal of values goes down, the debt—fixed in amount—becomes more burdensome. So much of the debt burden to-day is due not so much to the actual amount of the debt as to its relative amount as compared with values as they are appraised and written down under present conditions.

Finally, the fact that strikes us most forcibly and that is perhaps at the roots of some of these other items that I have mentioned, is that we are living in a business world teeming with distrust and apprehension.

The Construction Industry

In this general picture where do we find the construction industry? In order to relate construction to the general business picture, let us get a clear idea of just what we mean by the construction business. The construction business is engaged in the fixing of capital in new facilities, for production, for commerce, and for community service. Now, then, this capital must be drawn from the surplus earnings of business or from the borrowings that discount future earnings. There is no other source from which it can flow.

Here is involved the basic problem of every capitalistic society—that of determining the proper division of surplus earnings between the wage fund—which includes the wages of capital, as interest and dividends, and which finances the consumption of goods—and the investment or capital fund that is applied to the provision of further facilities for production.

If we could employ some super-mind, that each year would take our surplus earnings and apportion them properly—on the one hand to consuming power in the form of wages, interest and dividends, and on the other to reinvestment in the various forms of capital—we should have an end to booms and depressions; but, unfortunately, we have not yet learned how to do that. So we must leave this vital function to the whim of the individual, to the fluctuations of supply and demand, and to the uncontrolled manipulation of speculative enterprise. And the prosperity of this construction industry of ours depends upon the wisdom with which we happen to appropriate the surplus earnings of industry to the wage fund, on the one hand, in order to create consumption, and to the investment fund, on the other hand, in order to provide new capital for new agencies of production and service.

The Construction Record of 1931

What is the present status of construction volume? I have here a summary as of the end of December, compared with a year ago (1930), and two years ago (1929). The volume of engineering contracts awarded—that does not include small dwellings, but only the large, heavy buildings, public works, public utilities, and engineering improvements—in 1931 was 77 per cent. of the volume of 1930. It was 62 per cent. of the volume in 1929. It is noticeable that public works contracts in 1931 amount to 102 per cent. of the public-works con-

* Presented at the National Sand & Gravel Assn. convention at Pittsburgh, Jan. 27, 1932.

tracts awarded in 1930, and 105 per cent. of the public-works contracts awarded in 1929; whereas private works amount to only 58 per cent. of the volume of contracts awarded in 1930 as against 40 per cent. in 1929.

There are two or three interesting points about these figures. The first is that they represent dollar values and, as our cost index is now 16½ per cent. below that of a year ago, it is evident that there has been a much larger volume of actual construction than is implied by the dollar value. Furthermore, the 16½ per cent. itself is low because, being a cost index, it is based upon prices and wages. But it takes no account of greater efficiency of production and management. A dollar's worth of labor or of management to-day produces a great deal more than did a dollar's worth of labor or management two years ago. So it is probable that the reduction in actual costs is much more than 16½ per cent.

Another point of interest is that these figures compare favorably with the volume of construction contracts awarded in 1925. They are only 4 per cent. lower than the 1925 volume. There were not very many of us, as I remember, who were panic-stricken by business conditions in 1925. There is just this difference: that in 1931 public works were 58 per cent. of the total and in 1925 they were only 40 per cent. of the total. So much, then, for the picture of where we stand now.

The Essentials of Construction

Under favorable conditions, such as low prices of labor, materials, and credit, why is there not more construction? Obviously, this would be a good time to fix capital. When we can fix capital at low cost we shall have less interest to pay over the life of the investment; and it would seem that now would be a good time to fix capital—in other words, to engage in construction operations. But, as you see, we are only doing 60 or 70 per cent. of what we did a year ago. Why?

Three factors enter into every construction undertaking. The first of these is the promoter of a new enterprise, or the operator of an existing enterprise which contemplates expansion. The second is the investor who supplies the necessary funds. The third is the agency of investment—the banker, the insurance company, or whoever may act as the intermediary between the investor and the promoter. Let us examine the mental attitude of each of these three elements under present conditions.

(1) The promoter. We find, in general, that the promoter shrinks from new enterprise because of his feeling that the country is overbuilt and because he fears that there may be no market for the products of the new facilities that he might provide. In other words, he fears that we are overequipped with floor space and with productive capacity, so he is reluctant to engage in a new enterprise or to expand his existing enterprise.

(2) Turning now to the investor, who provides the necessary surplus funds for the promoter, we find that he is so doubtful and uncertain as to where he may invest wisely that he has retired into his shell and decided for the time being to invest nowhere and has practically withdrawn from the market. On the part of some investors we find a fear that the general burden of unliquidated debt is going to drain the purchasing power of the people. He fears, in other words, that the general purchasing power will be so absorbed in the liquidation of present indebtedness that there will be none available to consume the products of new enterprise.

(3) The third element, the financier, is oppressed by the fear that withdrawals of funds and inability to realize quickly on his banking assets may impair his liquidity—and the banker to-day knows only that one god of liquidity—so he has withdrawn his credit from new enterprise and restricted that of the going concern. He prefers the security derived from holding his assets under his hand to the opportunity to invest them in the building of constructive enterprise.

We find that the insurance companies are hampered because so much of their assets are tied up in loans to their own policyholders. An insurance company president reported not long ago that whereas ⅛ of its assets normally would be in the form of loans to its policyholders, to-day 32 per per cent. of his company's assets are tied up in such loans.

In other words, to sum up the psychology of those three essential groups, we find that caution has replaced enterprise and safety has supplanted risk; and investment in new construction is the child of both enterprise and risk.

The Influences at Work

Now, then, let us examine each of these influences and see what justification there may be for these states of mind and what influences there may be at work to affect them.

First, the built-up idea. There is nothing new about this. In 1923 I sat with a group of men who knew the construction industry, well-equipped with charts and tables and data, and we were satisfied that the country was overbuilt. We proved it conclusively and we wanted someone to do something about stopping any further investment in construction. We all know what has happened since 1923. There is nothing new about that.

The next influence is that the United States of America is still living in its constructive era. If I were asked to point out the one distinctive difference between American and European business psychology I should say that America is still a construction project, while Europe is an operating proposition. We are still building America. As yet, we have not scratched the surface of our resources. We have begun to plumb the desires and the needs of our people; and in our generation and the next generation we probably shall not approach the business status of the Old World, which for the most part is an operating proposition. So we need have no qualms as to the future of the construction

industry. We need not fear that we are built up or that we have exhausted our resources or that we have reached a plane upon which we must stabilize on an operating basis. We still have a future for constructive enterprise.

Naturally, there is at the moment a surplus of dwellings and business and industrial buildings. There is a surplus of almost everything, except confidence. We know that many families have doubled up and are living in quarters occupied by one family in better days. We know that business is seeking smaller quarters, and we know that factories are only using part of their facilities; but we can not afford to judge our potential demand for housing and for other facilities on the basis of present conditions. For the moment we must trim our sail to meet present conditions; but we must not plan on supplying the needs of this growing country of ours on the basis of present conditions.

Furthermore, the standards of floor space are not static. The demand is not only for *more* floor space, but also for *better* floor space, more modern floor space, more modern facilities. Furthermore, the entire art and science of housing is still in its infancy. If we compare our present homes with those of our childhood, with the generation just behind us, we shall realize that there has been a rise in the standards of housing that will be duplicated or perhaps triplicated in the years to come.

Finally, we need not be frightened by the statisticians who show us a decline in the rate of our population increase. For the demand for goods to serve the American people is not measured by our growth in population alone; it is measured by the growth of our needs and desires and wants, and by the growth of our capacity to gratify them. And if we continue to increase the earning power of the average citizen, as we have done in the past, we can see scarcely any limit to his needs and wants and desires or to his ability to gratify them. So we need not be frightened by the idea that our rate of population increase is falling off. This country can not be "built up." We may have caught up with ourselves for the moment, but it is just for the moment.

A Gloomy Prophecy

What of the fear that there may be no market for the products of new factories. Let me quote something written by a very eminent economist after a most exhaustive study of the whole subject of business depressions and of the status of American industry. He says:

"Industry has been enormously developed, cities have been transformed, distances covered, and a new set of economic tools has been given in profusion to rich countries and in a more reasonable amount to poorer ones. What is strictly necessary has been done—oftentimes to superfluity. This full supply of economic tools to meet the wants of nearly all branches of commerce in industry is the most important factor in the present industrial depression.

"It is true that the discovery of new processes of manufacture will undoubtedly continue, and that this will act as an ameliorating influence; but it will not leave room for marked extension, such as has been witnessed during the last fifty years, or afford a remunerative employment of the vast amount of capital which has been created during that period.

"The day of large profits is probably past. There may be room for further intensive but not extensive development of industry in the present areas of civilization. Supplying themselves with full facilities for industry and commerce will give to each of the great nations of Europe and America something to do, but the part of each in this work will be small and far from enough to insure more than temporary activity."

A rather depressing picture, is it not? And we might feel much sobered by this pronouncement if I neglected to say that these words were written in 1886. So we have the prophet of woe with us always. And when we contemplate the current expansion of the frontiers of science, and when we see the new facilities, the new powers and the new resources that are being brought to bear upon the increasing wants and needs of our people, I do not think that we need worry about having reached a saturation point for the products and services that our industry can produce. It's no more true to-day than it was in 1886.

Not long ago a General Electric official reported that in 1929 one-quarter of the total production of that company was made up of new lines that had been created since the war. To-day we have potential industries still unborn or in their swaddling clothes; and if we live to our normal expectancy, we shall see accepted as commonplaces of our daily life a host of conveniences, luxuries and necessities that to-day are in their infancy, some of them merely experimental toys of the laboratory.

Let us turn our minds back a few years and recall what has happened in the field of the radio, of the automobile, and of refrigeration, and we shall get a picture of what is going to happen in the next decade and in the next quarter-century. Have no fear that there will be lacking new products and services for the American people.

Furthermore, when once we have dispelled this psychology of fear there will be an immediate demand for modern plant and equipment to help us batter down our costs and to realize higher efficiencies so that we may still further increase the productivity and the unit buying power of our people. Our trouble is not a lack of demand or need, but rather a lack of lenders to provide the funds necessary to finance those needs.

To Restore Confidence

The investors' doubts can be resolved only by the restoration of confidence, and every action that is being taken by the federal government offers hope toward this end. To-day the most powerful agencies that the government can command are being applied to the task of restoring confidence, of dispelling fear, of removing the distrust and apprehension that have paralyzed the agencies of credit that we need to carry on. I

can not prophecy how successful this effort will be, but certainly we must agree that its objective is a prime essential that will justify the energetic measures now being taken to achieve it.

As to the debt burden draining our current purchasing power, there can be no question. There is scarcely a man who has not cut down his current spending because of the necessity for liquidating debts. But therein lies the remedy for that evil; those debts will be liquidated, they will be paid off, they are being paid off. While we are talking about it that burden is being reduced in absolute value. It is being written off by reorganization and compromise, and it will be lightened by the general progress of recovery.

Debt is relative. A debt is burdensome or not burdensome as compared with the public appraisal of worth. If the public writes your worth up, a fixed debt is no longer burdensome; if the public writes your worth down, the debt becomes burdensome; and, as I have said, a very great deal of the burden of debt to-day exists because worth has been written down so extravagantly. With returning confidence this will tend toward improvement. And so we have these three influences operating to help liquidate the burden of debt that hangs over us and to remove that doubt from the mind of the investor.

The banker's fear is lack of liquidity: He, too, will be influenced by the work that is being done through governmental agencies. Perhaps the most important factor in that picture—or one of the most important factors—is the railroad situation. The paralysis of credit facilities probably has been brought about to a considerable degree by the lack of confidence in railroad credit, that vast avenue of investment for so many of our financial institutions: If something can be done—and something already has been done—to improve the credit status of the railroads, we may hope to see a general improvement in the credit status of business generally.

What Are Our Responsibilities?

Now, in the face of these conditions, what are our responsibilities as a group? Here, it seems to me, are the responsibilities that face all of us who have a stake in this construction industry.

First, to seek an integration of the construction industry, in order to eliminate wasteful and destructive practices. We talk about the construction industry, but in fact there is no construction industry. That is one of our great difficulties. There is a group of related industries, each trying to be sufficient unto itself, to live off the others, to make all it can off the other elements of the group; and this gives rise, right within our own ranks, to many of the evils that bedevil us. Everything that can be done toward the integration of the construction industry, financial groups, the designing groups, the contracting groups, the material and equipment groups, and all the elements that go to constitute this activity called the construction industry, will help to eliminate wasteful and destructive practices and thus help put our house in order.

We are a dispersed industry. We are composed of a tremendous number of small units of which there is little or no integration. Because of that, we are an irresponsible industry. Because we have so many independent groups, each broken up into so many small units, we find it impossible to control the responsibility of these units or even a substantial part of them. I should say that irresponsibility is one of the chief difficulties throughout all the groups that constitute the construction industry.

Because of this dispersion, this large number of groups, this irresponsibility of the independent producing unit, we have always with us the problem of the marginal, high-cost producer who comes into action when there is lots of business and then is prone to bedevil the price structure when there is not lots of business. In a time like this there can be no health for any industry that must support, upon a much restricted volume of business, a large number of inefficient producers. Any association in any department of the construction industry is not doing its industry a favor when it tries in such a time to perpetuate the unfit. The time has come for the operation of the law of the survival of the fittest, and we shall do far better for ourselves and for the community we serve to foster the preservation of the fit and competent. In other words, we sometimes are inclined to think that the welfare of the industry requires the preservation of every last unit engaged in the industry, forgetting that its basic soundness must depend in the long run upon the efficiency of its combined service to the community. We should help all to survive, but we must do it by showing them how to earn survival rather than by seeking to shelter them from the operation of inevitable economic influences.

The Place of Group Effort

It seems to me that associated effort in any industry should have other objectives in a time such as this. What are they?

First, I think that our associated effort should impress upon our members that government loans and emergency credits are palliatives and not cures. We are never going to cure a debt-created situation by borrowing some more or by artificially-expanded credit. These are valuable to protect the sound institution against the effect of panicky deflation of values but, if they are going to do us any permanent good they must be matched by more economical operation and the reduction of costs.

We must foster more efficient production and more efficient merchandising. The latter does not mean high-pressure selling. It does not mean forcing upon the public an inferior product at an inflated price. It means making the best product that we can by the most efficient possible means and getting it into the hands of the consumer or user at the lowest possible price. That is the sole objective of modern merchandising.

Our next responsibility that we have is to see that the credits made available to help us out of this situation are not squandered. There is much very

well-intentioned, very honest and very sincere thought being devoted to some of our present problems, but there is a lot of it that is very, very mistaken.

The Hand-Labor Fallacy

For a moment let us consider one of them. We have an unemployment problem, and we have many people trying to solve it. Many of them are doing some wise and fine things, many of them are doing some foolish things. And when any state or other community abandons modern methods and reverts to primitive methods in order to remedy unemployment, it is but making a bad matter worse.

Hand labor to replace efficient modern methods never can be the answer. To remedy unemployment we need additional employment, not the provision of wasteful employment to replace efficient employment, creation of work for one group of men by throwing out of employment a larger group of men.

What we need is *additional* employment. And, if we are going to have additional employment we must pay for it. But there is only one source of funds to pay for it, and that is the surplus earnings of the people who already have jobs. We can not raise unemployment funds out of thin air or out of the magician's hat. We can get unemployment relief funds only from the surplus earnings of the people who are working; and it makes no difference whether it be in the form of taxes for public improvements which come out of the pockets of business and the employed citizen or whether it be in the form of donations from those who are in more fortunate circumstances. The money can only come from the surplus earnings of those who are at work.

Obviously, that means that we should carry on the work we have to do as efficiently as possible in order that we may not squander the resources available to carry on that necessary work, because for every dollar that we squander we are losing a dollar that might be available to finance additional work. That is so clear and so simple that it scarcely need be stated; yet there are those who propose that we revert to primitive and wasteful methods of doing our work under the delusion that somehow or other they are going to create more work for more people. If we have $50 of the taxpayers' money to do a piece of public work and we do it by methods that will cost the taxpayer $50, when we could do it for only $25, we have $25 less to spend for additional work that might give employment to others. Furthermore, when we abandon modern methods of carrying on our work, we are starting another train of unemployment that goes back through the storehouses of our distributors and the factories which produce the machinery, the raw materials, the fuel and the supplies that are required.

Our economic picture has changed since a hundred years ago. We are living not in a primitive civilization, but in an industrial civilization and we can not revert to the primitive methods of a hundred years ago at one place in the cycle without doing a lot of damage somewhere else in that cycle.

It all is so pathetic; yet it is being done to-day in many communities. So one of the first things that we should do is to see that the resources made available in the form of public credits—and I say public credits especially, because there is very little chance of private credits being squandered in that way; the return on private credits is much more immediate and much more closely scrutinized than the return on public credits—are not squandered by mistaken methods and thereby create more unemployment. Indeed, every law fostering hand labor rather than power processes might well be entitled "An Act to Increase Unemployment in the United States". If it is sensible to replace a power shovel by a hand shovel, then it is more sensible to replace the hand shovel by a teaspoon. Thereby we surely make more work for more men. And it would be equally sensible to replace motor trucks by wheelbarrows, because again we would make more work for more men.

But the fact is that by such a process we squander our resources available for additional work much faster than those wasteful methods can absorb additional workers. We are in a descending vicious spiral that just carries us lower with every turn.

Then we must continue our best effort to reduce our debts—public, corporate, and private. If the burden of debt is relative, then as we seek through legislation and otherwise to raise the ceiling of public confidence and with it the public appraisal of worth, we must lower the floor of actual debt. And if we can raise the ceiling of confidence and lower the floor of debt we are widening that margin between debt and worth; we are opening wider the door that leads out of our present situation, so each one of us must do his part by helping to lower that floor of debt.

The Place of Public Works

Furthermore, I think that the construction group must recognize that there is a limit to expenditures for public works under our present governmental fiscal system. After all, public works must ultimately be paid for under our present system by the consumer taxpayer.

I recognize that there is an emergency value to public-works construction. Construction is one of the few major industrial activities that creates a wage fund available to increase consuming power without, at the same time, creating more goods that must be bought. In other words, when a manufacturer doubles his operations he pays out twice as much in wages, let us say, to increase consuming power; but he has made twice as much goods that must be bought. So we do not get ahead very fast. But when we spend money on construction, especially public works, we are creating a wage fund to increase consumption without, at the moment, producing more goods that must be bought and thereby outweigh the effect of the increased wage fund. But they must be paid for some time—in the form of taxes to meet interest and amortization—and there is a limit to the extent that we can discount

the future need for public works and create services that must be bought even though they may be paid for over a period of years.

So, while I am in favor of stimulating public works at this time as an emergency measure, I think we should do it with our eyes wide open, conscious that it is an emergency method, and that we are pumping the old strychnine into our system. Let us not "kid" ourselves as to that.

Sooner or later we shall learn how to redress the balance between consumption and productive capacity through a radical revision of our governmental fiscal systems that will enable us to provide for public works out of direct levies upon the surplus earnings of industry. Then we shall be able to divert from the arena of private finance and private speculation a share of our surplus earnings, with which to pay for necessary public works, thereby financing increased consumption without counterbalancing production of goods, while at the same time we add many community facilities to the public wealth without additional burden to the consuming taxpayer. But this is another story that cannot be discussed within the limits of this article, and until that day comes we must remember that our public improvements must be paid for by the general consumer taxpayer just as are any other commodities that he may buy.

Finally, may I sum up in just four or five sentences all that I have said. What can we do?

First, set our own house in order. No miracle is going to happen, no miracle man is on the horizon. That means the strictest efficiency and the use of modern methods for the elimination of waste in production and distribution. It means the reduction of our costs to the lowest level that can be reached by the most efficient producer who can still find a market for his products. It means the elimination of inefficient producer, the elimination of irresponsibility, as far as possible, from our respective groups. It means not more borrowing, but the continuous liquidation of our present debts so far as practicable—maybe only a little at a time, but continuous—and it means the discouragement of "wild-cat" speculation. With a turn for the better, the old "wild-cats" are going to be loose again, and it will be a sore temptation to the producer to encourage "wild-cat" speculation to make a market for his products. But that is not the way out. If we have the courage and resolution to match our wisdom, we shall see that "wild-cat" speculation is suppressed until we can get our feet surely on the earth.

Then we must seek to foster construction programs that have a real economic justification and not simply efforts to make work by spending all that we can borrow.

And, finally, we must combat courageously fallacies that may seem to offer a momentary relief but in the long run will leave us worse off than we are now.

Specifications and Test Methods for Concrete Being Considered

Several subcommittees of A.S.T.M. Committee C-9 on Concrete and Concrete Aggregates reported on important standard specifications and test methods at the meeting of the committee in Cleveland on Tuesday, March 8. This meeting was in conjunction with the group meetings of A.S.T.M. committees held in the Hotel Cleveland, March 7 to 11.

The Subcommittee on Specifications and Methods of Tests of Aggregates has in preparation a method of test for absorption of aggregates and also presented to Committee C-9 at this meeting a preliminary specification covering light-weight aggregates.

An extensive paper, *Study of the Dunagan Buoyancy Apparatus,* was also presented to the committee. This apparatus is designed for the analysis of fresh concrete. The paper, prepared by H. R. Nettles and J. M. Holme of the Fritz Engineering Laboratory at Lehigh University, will be circulated in the committee for consideration as a committee paper looking toward possible publication in the 1933 report.

The Subcommittee on Ready-Mixed Concrete has in preparation a purchase specification for ready-mixed concrete which, it is expected, will meet with considerable favor when available. With such a widespread use of this type of concrete it is especially urgent that a standard specification be drawn up to enable all those who plan to use this material to purchase it under a definite standard.

Considerable work has also been done in the committee on tests for durability by freezing and thawing. This work will result very shortly in a suggested method of procedure for making freezing and thawing tests of concrete and concrete aggregates which will be issued as a tentative standard method.

Two other papers were submitted to the committee at this meeting. The first on *The Action of Waters on Concrete,* by B. Kellam, assistant chemist of the Hydro-Electric Power Commission of Canada, records data on the action of various river and lake waters on concrete in various sections of Canada.

The second paper, *Field Survey of Concrete Structures,* by E. W. Bauman, engineer of tests, Tennessee Highway Dept., discusses the weathering of concrete structures in the south-central section of the country.

The committee also took action to recommend to the Society certain changes in existing standard and tentative standard specifications and methods of testing concrete and concrete aggregates.

The officers of Committee C-9 on Concrete and Concrete Aggregates are: Chairman, Cloyd M. Chapman, consulting engineer, United Engineers & Constructors, Inc.; secretary, Stanton Walker, director, Engineering and Research Division, National Sand & Gravel Assn.

Super-Cement Plant Designed to Yield a Quality Product at Lower Cost

By AMAN MOORE

WITH this article is submitted a floor plan of a modern type of the cement plant of to-day, a super plant designed to produce super-quality cement at minimum cost. This plant is designed to manufacture not only quick-hardening Portland cement, but also white cement, marine cement, gypsum products, magnesite products, complete fertilizer products, raw and burned lime products, and gas-ice as a by-product.

In referring to the drawing I shall briefly follow a flow-line from crusher to truck or railroad cars. The crushing plant (marked 1 in the drawing) includes a primary gyratory crusher that is large enough to receive a rock at least 5 ft. by 7 ft. A large electrical steam shovel, having a dipper of not less than 6-cu. yd. capacity will load directly into railway cars, which will be dumped into the crusher by overturning them in a tumbling barrel directly over the crusher. The rock will pass over a grizzly, the residue from which will go to the secondary crusher. From here part of the rock used for cement manufacturing will go directly to concrete storage-silos (2 and 2A), which will be 30 ft. in diameter by 90 ft. high. The rest will pass over rolls, where it will be sized to supply various products including lime dust, chicken grits, pebble dash in ¼-in. to ½-in. sizes; and rock in ¾-in. to 1½-in. sizes, and in 3-in. to 6-in. sizes for sugar manufacturing. The same flow-line will be followed for crushing magnesite rock, gypsum rock, phosphate rock, and shales for the cement mix. Different concrete-silo storage-tanks will be used for keeping the various kinds of crushed products separately stored.

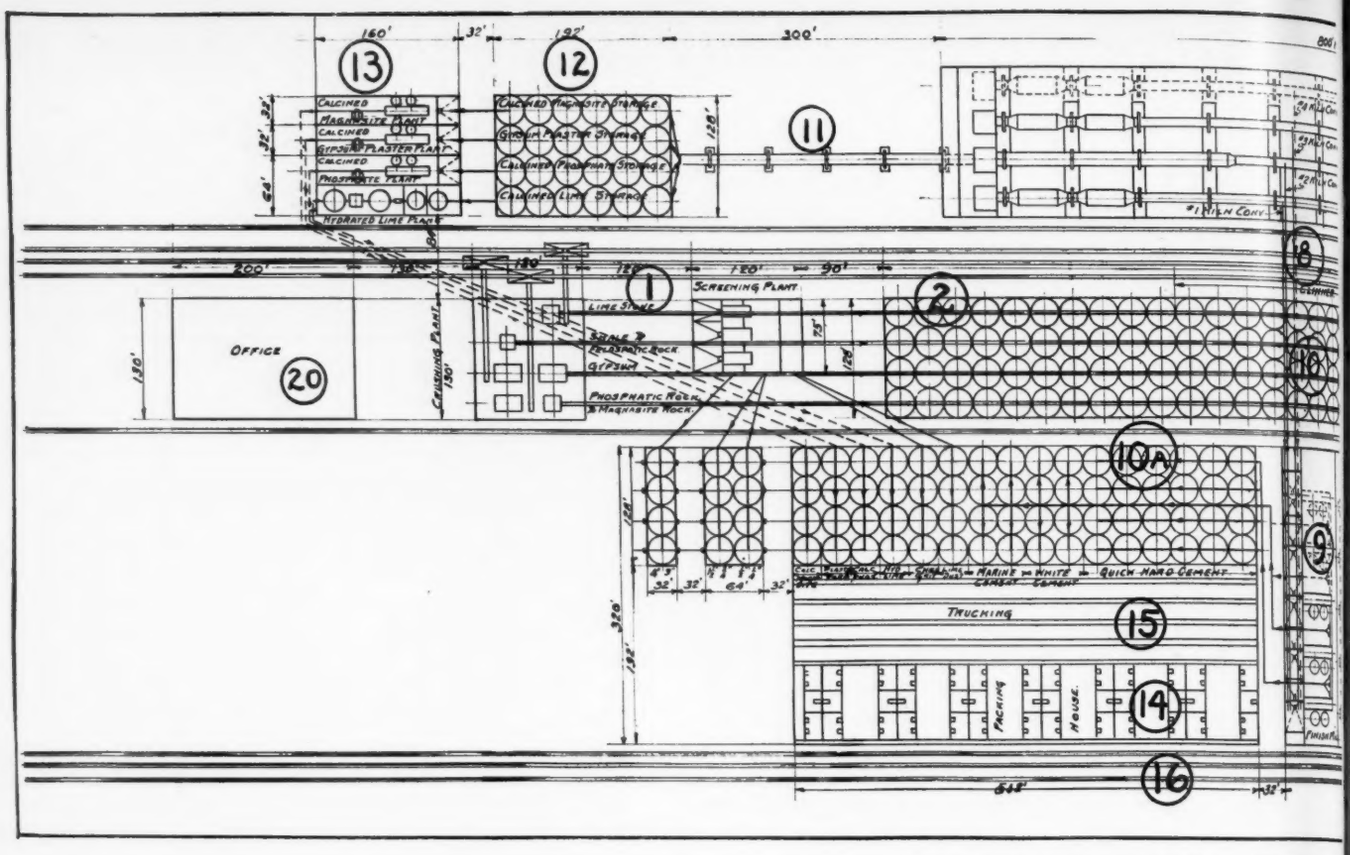
In the operation for which this lay-out was designed two types of shale, one a feldspatic rock high in aluminum and the other a shale very high in iron, will be used. These materials are also crushed separately and stored in separate concrete silos. The crushed lime rock and the high-aluminum and high-iron shale will be drawn from the concrete storage-silos and passed on to hoppers over the raw-grinding mills (3). Each type of shale and lime rock will be ground in separate grinding mills, which will employ the closed-circuit system and will use thickening basins (3A) or the material will pass directly into storage tanks (3B) located at the back end and under the kilns. In the storage and correction tanks a proper mix of the slurry will be made and after the mix will have been corrected it will be passed on to vacuum filter-presses (4), where the water content will be reduced and where the filter-cake when entering the back end of the kiln will contain approximately 18 per cent. of water.

In determining the length of the kilns (5) efficiency of fuel and low temperature of stack gases are the main guiding factors. It is planned to line the entire length of the kilns with fire-brick, using at least 1 in. of fireproofing cement between the kiln-lining brick and the kiln shell. The object is to prevent, as nearly as possible, the radiation of heat through the kiln shells. Using a kiln length of 800 ft., the stack temperatures will be approximately 425 deg. F., at which temperature the gases can be passed through woolen bags in the bag-house (6), installed directly behind the kilns. By the time the gases will have passed through the meshes of the woolen bags in the bag-house, which will be 500 ft. in length, the temperature of the gases will be reduced to approximately 225 deg. F. Practically all solids in the gases, including waste dust from cement materials volatilized potash, etc., should be removed. By the time the gases will have been drawn by fans from the further end of the bag-house they will be in proper condition to enter the gas-ice recovery plant (7), or if a surplus of the cool cleaned kiln gases should occur it can be forced up the stack (8).

A double set of soaking zones is provided for kilns No. 1 and No. 3. In Kiln No. 1, it is planned to manufacture 3,000 bbl. daily of white cement, and in Kiln No. 3, 6,000 bbl. per day of quick-hardening Portland cement with only one burning. The back section of Kiln No. 1 will be 9 ft. in diameter and the soaking zones 11 ft. 6 in. in diameter. The back end of Kiln No. 3 will be 11 ft. 6 in. in diameter and the soaking zones in front 15 ft. in diameter.

Kiln No. 2 will be 600 ft. long and 9 ft. in diameter, the front 200 ft. being an enlargement 11 ft. 6 in. in diameter. Soaking zones will not be provided in Kiln No. 2 because this kiln will be used to manufacture marine or high-iron cement part of the time and then alternately to calcine, separately in the rock form, magnesite, gypsum, phosphate rock, and limestone.

Each kiln will be provided with a cooler doubling back from the discharge end to separate belt-conveyors (8). The coolers will be approximately 320 ft. long and 9 ft. in diameter. A sealed stationary hood will prevent cold air from entering between the discharge end of the kiln and the cooler, so that all the air entering the kiln will be preheated to a temperature of 1,000 deg. F., or more. When the clinker is discharged to the conveyors it should be so cool that no difficulty will be experienced in handling it in one's naked hand. The clinker will pass to cement-grinding mills (9), a separate grinding mill for each of the three types of cement to be delivered. These grinding mills will be of the closed-circuit type. Each will have four compartments and will be constructed so that each compartment will empty completely at the end of the compartment, the product passing over air-separators and only the coarse materials passing on to the next compartment. By this method the fines will be removed from the coarse particles and so prevent the forma-



Lay-out of a super cement plant. The encircl

tion of a cushion that reduces the efficiency of the grinding balls approximately 50 per cent. In other words, a mill of this type is presumed to give approximately double the capacity and to grind much more finely with the consumption of approximately the same h.p. as other types of tube and compartment mills.

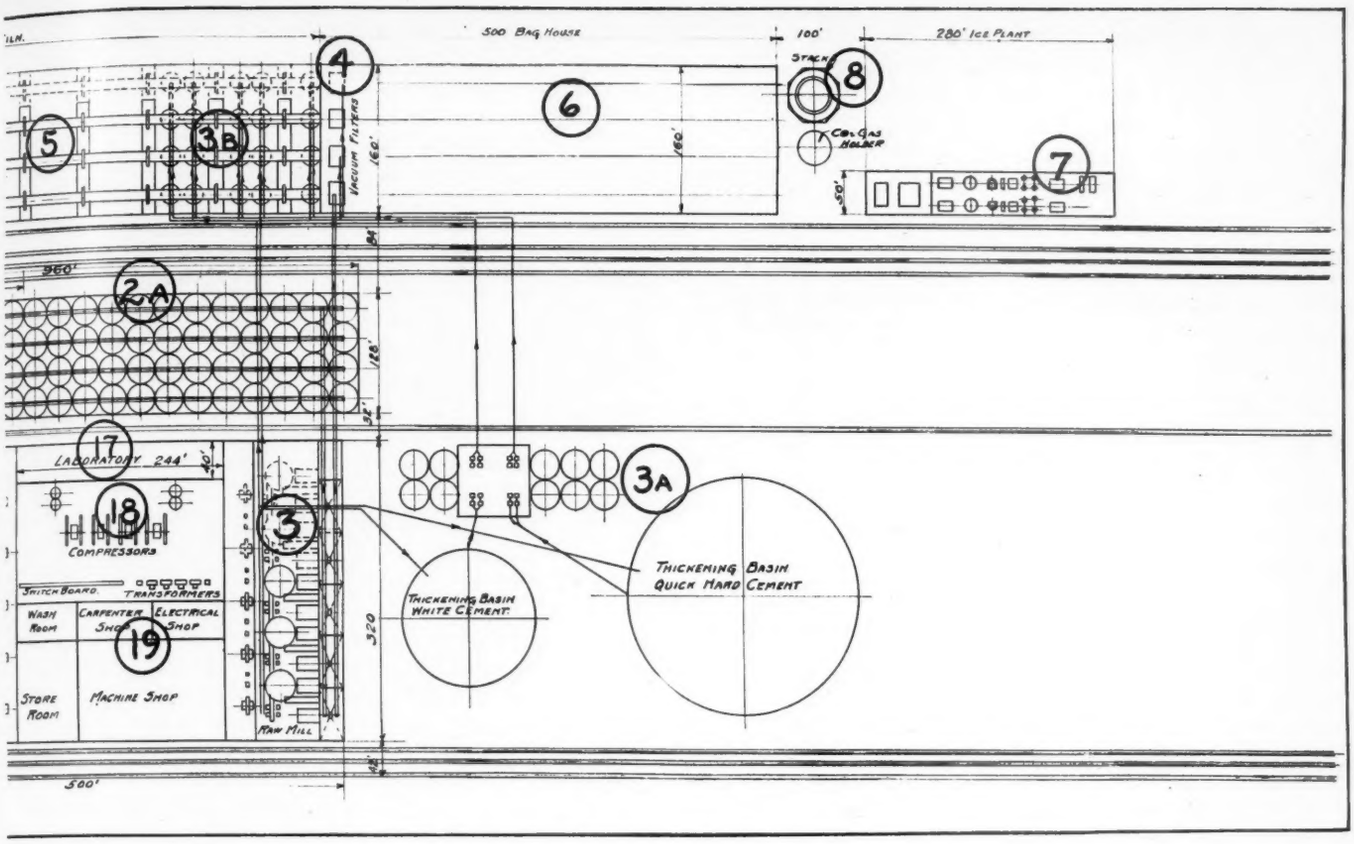
When the hoppers over the grinding mills are full, the cement clinker will be stored in clinker storage-bins (10), and the conveyors (8) will pass at right angles over the tops of the raw-material conveyors leading from the same bins, conveying raw materials from the crushing plant. All the storage-bins can be used either for clinker, or for any one of the several kinds of raw crushed rock and shale. All the storage-bins will be provided with hopper bottoms and will have conveyors underneath them for emptying the bins and returning the product either to clinker-grinding mills or to raw-grinding mills.

The different brands of cement will be pumped from the grinding mills (9) to the concrete-silo-cement storage-tanks (10A), which will be constructed in the same manner as those shown at 2, 2A, and 10 and will have as 2, 2A and 10, a diameter of 30 ft. and a height of approximately 90 ft.

Kiln No. 2 will be provided with a second cooler (11) which will extend directly in front of the discharge end of the kiln and will be of approximately the same length and size as the other coolers, which double back underneath the three kilns. As the different raw materials—crushed magnesite rock, crushed gypsum rock, crushed phosphate rock, and crushed limestone—will be passed through kiln No. 2 separately for calcining, it is planned to empty the kiln and the cooler after calcining one type of rock and before calcining another type of rock. It was because of this changing from one type of material to another that Kiln No. 2 will not be provided with soaking zones.

Kiln No. 2 will also have a Dutch oven, or preheating furnace, constructed to prevent overheating by direct contact of the raw gypsum rock with the flame while calcining. Each of the calcined materials—magnesite, gypsum, phosphate rock, and limestone will be discharged from the cooler to separate rows of concrete storage-silos (12) and from these they will be separately drawn from underneath and passed on to separate plants (13) for grinding them. The calcined lime will be passed through hydrators. These materials, after grinding and (in the case of lime) after hydrating, will be pumped into separate rows of storage-tanks located in a part of the main storage-plant (10A), alongside the silos containing the quick-hardening cement, white cement, marine cement, the lime dust, chicken grits, etc.

The packing plant (14) will have separate packers for packing each of the several products separately and simultaneously. These products can be loaded in trucks in the space provided for that purpose (15), or in railroad cars (16). Above the packers for white cement provision will be made for grinding with the white cement various colored pigments, so as to produce all the major colored cements as well as white cement. Over the packers



figures are referred to in the text.

for plaster of Paris provision will be made for adding retarder, fiber, etc., for producing hard wall plaster. Over the packers for the calcined phosphate rock provision will be made for adding nitrates, or potash, or raw-ground gypsum, or raw-ground lime to produce different types of complete mineral fertilizers for the general trade.

The laboratory (17) will be equipped with miniature plants for original research work, as well as both physical and chemical laboratories for testing the raw and finished products.

The electrical room (18) will contain compressors, transformers, switch-boards, etc., and will be connected with space wherein will be located the large motors operating the grinding mills for both raw and finished products.

Space (19) for the wash room, carpenter shop, electrical shop, store-room and machine shop will adjoin the electrical room and will lie between the raw and finished-grinding departments.

The office (20) can be placed at whatever point may be found most convenient for entrance to plant.

The plant will be provided with a complete system of dust-collectors. A hood of ample-size will be installed over each piece of machinery where dust is generated. The plant should be as clean as a city office-building. The economy resulting from the saving in waste will more than pay the interest on the investment needed for the installation of a complete dust-collecting system, and, besides, the convenience to the mill operating force will be an additional asset.

All raw and calcined materials will be handled only through closed storage-tanks, which will prevent the escape of dust or loss by wind and will also prevent the depreciation in the quality of the product caused by exposure to rain when stored in the open. All coarse materials will be handled throughout the plant by belt-conveyor systems and fine products by pumping by compressed air through pipe-lines.

The location of the projected plant will be within the metropolitan district of one of the largest cities in the United States, where either gas, fuel, oil, or slack coal will be available through pipe-lines, thus eliminating freight charges for fuel.

It is contemplated to install, at a later date crushing and grinding equipment at the quarry from which the ground slurry, containing somewhere between 50 per cent. and 90 per cent. of water, will be pumped through an 8 in. pipe-line to the plant. By the use of such transportation of the raw material the cost of delivering a ton of rock to the plant will be reduced to only a few cents.

The old system of locating numerous small plants at isolated points where limestone deposits exist, should, in my opinion, be a matter of history. A few large units should be constructed near, or within the metropolitan districts of the largest cities of the United States. The raw materials ground to a fine slurry at the deposits should then be pumped to the plants, located where the market exists. The fuel, too, should be piped to the plants. A great saving in transportation cost, and hence a great reduction in the cost of producing and delivering a barrel of cement at point of market, would naturally result.

Furthermore, if single units including six pieces of machinery—one preliminary crusher, one sec-

ondary crusher, one closed-circuit raw-grinding compartment mill, one kiln, one cooler, and one closed-circuit finish-grinding grinding compartment mill—will produce 6,000 bbl. each per day, then, with several of these units operating in one huge plant, the operating costs can be greatly reduced. Furthermore, the quality of the product will be more uniform and more nearly perfect. The quick-hardening Portland cement manufactured under such conditions will cost considerably less than ordinary Portland cement of a quality inferior to that of super quick-hardening cements, which can be produced more perfectly and to greater advantage in modern super cement plants. It is my belief that, if many of the cement factories in the United States were scrapped and a few super plants constructed near the largest cities a far better product would be supplied to the American cement consumer at a much less price than is available at present.

Virginia Leads in Production of Slab and Block Soapstone*

Virginia produces the greater part of the world's output of slab and block soapstone. The principal Virginia deposits form a large belt which extends through Nelson, Albemarle, and Orange Counties. Soapstone has been produced in Vermont, Maryland, North Carolina, Rhode Island, and New Hampshire, but all these operations have long since been abandoned.

Soapstone is a dense massive fine-grained rock. It varies in color from light gray through shades of blue to dark blue with occasionally a greenish cast.

The ease of workability is the most valuable characteristic of soapstone. Its comparative softness and its massive uniformity combine to make it the most easily fabricated of all natural stones. It may be tongued, grooved, trimmed, or bored with ordinary woodworking tools. Regardless of these characteristics, however, soapstone has remarkable transverse and compressive strengths.

Probably the earliest known uses of soapstone were dependent upon the ease with which it could be cut. Early Egyptian scarabs and amulets were carved steatite coated with a blue vitreous glaze. The Assyrians used it for signets, and numerous carved steatite ornaments were found among ruins in Rhodesia. For centuries the Chinese and Japanese have carved weird figures out of steatite or agalmatolite; the handiwork of the present generation may be purchased in any Oriental curio shop.

The cathedral of Trondhjem, Norway, was built about 1200 A.D. of soapstone from Gudbransdal. The structure recently was rebuilt to repair damage due to vandalism and fire, but otherwise the stone is in good condition. It has hardened considerably since the building was erected. Steatite found in association with serpentine near Cornwall, England, was used in the manufacture of old Worcester porcelain.

Soapstone was first used in the United States by the American Indians, who early recognized its heat-retaining qualities. Soapstone bowls, pots, cooking stones, and other utensils made by the Indians are on display in many museums. This utilization gave rise to the term "potstone," which still is applied to soapstone in some localities.

The chemical inertness of soapstone has led to its wide use for laboratory equipment; in fact, many modern laboratories are completely furnished with soapstone table tops, sinks, drain-boards, gutters, fume-hoods, shelving, floors, and tanks, as well as miscellaneous special equipment. Similar use of the stone is made in acid and other chemical plants for vats, floors, shelves, wainscoting and other parts of the plant which may be subjected to the destructive action of chemicals or fumes. These applications consume only about 10 per cent. of the total volume of soapstone produced.

The use of the stone in dye plants depends upon its low absorption as well as its chemical inertness. When soapstone tanks are used, it has been found possible to change from one color to another with no appreciable contamination by merely rinsing the tank thoroughly between solutions. These properties have encouraged its use in storage-tanks for acid or alkali solutions.

Soapstone is used for a variety of purposes in which the general adaptability of the stone is more important than its specific property of acid or alkali resistance. Among these uses are for photograph, blue-print, X-ray, and cardiagraph developing tanks; autopsy, mortuary, and mausoleum slabs; animal kennels and cages, particularly for hospitals and related institutions; and miscellaneous equipment for all types of research laboratories. One of the most extensive uses of block soapstone is for lining the smelting furnaces of sulphate (Kraft) pulp mills.

The other common uses of soapstone are more dependent upon its physical properties than its chemical composition. Laundry tubs and kitchen sinks are the oldest representatives of this group. They were first made at Alberene, Va., about 60 yr. ago. For more than 50 yr. they represented the greater part of the soapstone business. Within the past 10 yr., however, the laundry-tub market has decreased until now it comprises only about 10 per cent. of the total volume of soapstone production. Competitive materials, electric washing-machines, partial saturation of potential markets, promotional activities of laundries, and the trend toward apartment life have been responsible for the slump in the demand for laundry tubs. The sale of tubs finished in bright colors has aided in meeting the desire for color in home furnishings.

The durability, uniformity, workability, comparative nonabsorption, and neutral color of soapstone make it desirable for numerous architectural adaptations. The increased use of soapstones in building construction during the past few years has more than offset the decline in laundry-tub production. Large quantities of soapstone have been used for sanitary partitions, shower compartments, sills, in-

(*Continued on page 32*)

* Abstracted from U. S. Bureau of Mines Information Circular 6,563.

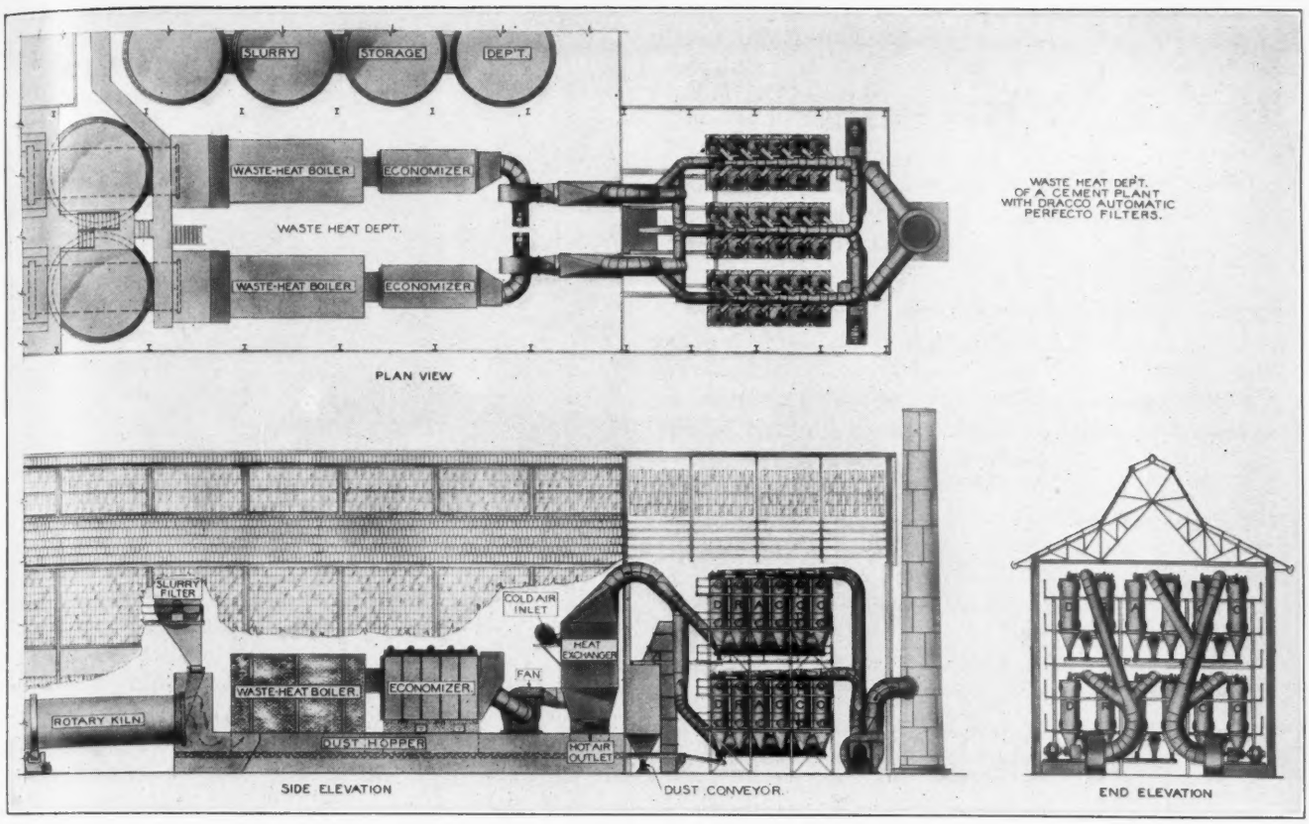


Fig. 1. Plan and elevations of waste-heat system with dust-collecting equipment.

Automatic Bag Filters Collect Kiln Dust at Ford Motor Co. Cement Plant

BY E. H. DE CONINGH
Technical Editor, Dust Recovering & Conveying Co.

IT is a well-known principle of Ford management that a man with general experience is a better choice for a specific operating job than a man of equal intelligence who has been educated in the particular field, based on the reasoning that it is easier to educate a man to certain fundamentals than to divorce him from preconceived ideas which may or may not be fundamentally sound. An analogous attitude is adopted toward new equipment and new methods; the generally-accepted method or design has to be proved to be the best before it is adopted, and the fact that a certain thing has not been done elsewhere is not considered to be in itself a valid objection to trying it.

This state of mind was clearly shown by the Ford engineers and operators in the design of the whole cement plant, and unorthodox methods were frequently adopted with great success. The wet process was selected for use on a blast-furnace slag and limestone raw mix, in spite of the general opinion that this could not be worked out, and a slurry-filter was used for the first time to avoid the previous objections to that application of the process. On the coal-preparation end this plant was one of the first to increase drier efficiency by circulating through it heated air withdrawn from hoods erected over the firing ends of the kilns.

The problem of kiln-dust recovery was deferred until the plant had been in operation for some time, but constant attention was called to the dust discharge by the other departments of the company. Cleanliness, inside and outside the buildings, is one of the first requirements of operation, and since the cement plant is approximately in the center of the Dearborn plant, it soon became obvious that equipment was necessary to remove the solids from the stack gas. The equipments considered included those which were in actual use on this problem, and, in addition, automatic bag-filters, which had proved satisfactory and economical for a large number of dust- and fume-collecting applications in the wide group of manufacturing and by-product industries carried on by the Ford organization. The engineering fundamentals of the filter lay-out were demonstrated to be sound, and this equipment was the final selection.

Only one kiln was equipped for the first run, which was considered to some extent experimental. The collection of the dust in the filters themselves was satisfactory, but the gas-cooling equipment between

the economizer and the filter intake required some redesigning. A plate-type air-preheater was used, and some condensation took place in the gas passages, where imperfect distribution caused a low velocity in some passages and a consequent plate temperature below the gas dew-point. Where this occurred, the dust was deposited in a hard cake, gradually cutting parts of the exchanger out of use.

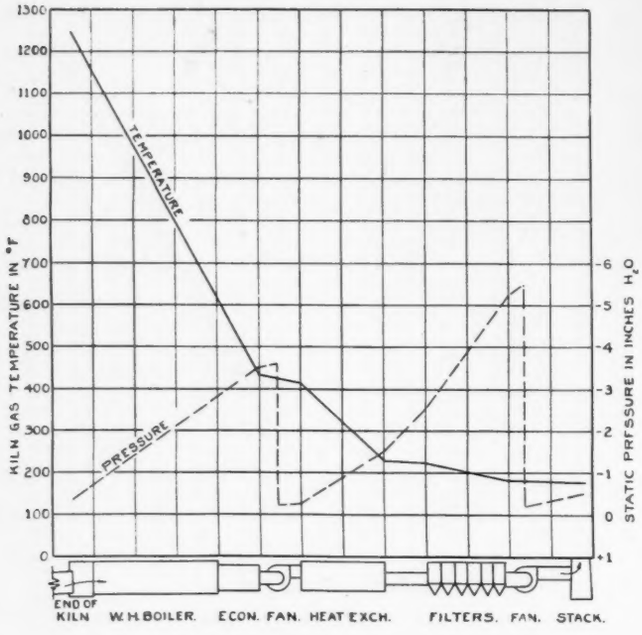


Fig. 2. Gas temperatures and pressure variations.

To overcome this the gas intake was redesigned, including a system of louvers to direct the gas flow evenly. It was possible to make accurate tests under these circumstances, and to design a larger exchanger of somewhat different proportions. With this preliminary work out of the way, a new heat-exchanger for this kiln was ordered, and a complete duplicate lay-out for the second kiln.

Fig. 1 shows the arrangement of the kiln gas-cooling and cleaning equipment, and the chart (Fig. 2) gives gas-temperature and- pressure variations from kiln to stack. Table I presents the data from

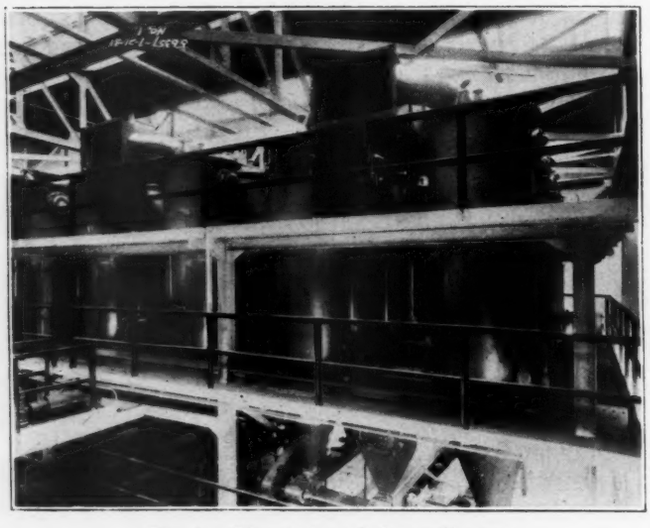


Fig. 3. Upper tier of dust-collectors.

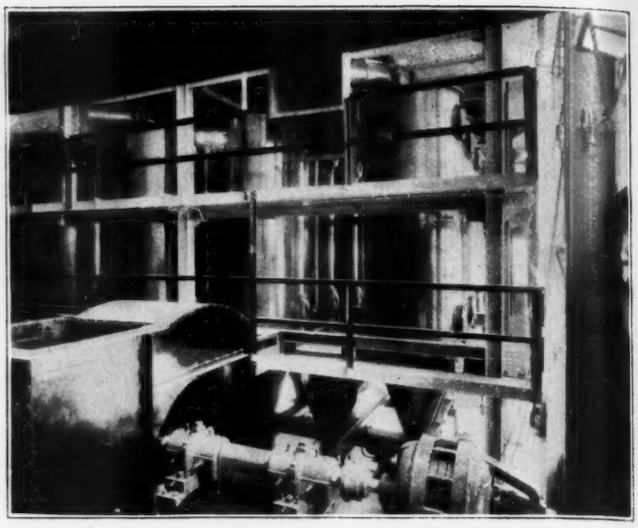


Fig. 4. Lower tier of collectors showing exhaust-fan and motor.

which the chart was made. Kiln exit temperature is about 1,250 deg. F., and the sensible heat from this point to 435 deg., F. is recovered in the waste-heat boiler and economizer, accomplishing the generation of sufficient steam to provide power to operate the plant. The required temperature at the filter inlet is 200 deg. to 230 deg. F., a 230 deg. average drop from previous stack temperature. This is accomplished through the larger heat-exchanger, in which earlier troubles from condensation have been avoided, in two ways: (1) as mentioned above, there is a set of louvers in the gas-intake hood, which are set to give approximately equal gas temperatures and velocities across the whole section of the exchanger; (2) there is a pipe connection from the air outlet to the air-inlet hood to provide for recirculation of a small percentage of the cooling air; there is a damper in this line, and this is set to maintain a minimum plate

TABLE I—KILN GAS TEMPERATURE AND PRESSURE

Location	Temperature (*deg. F.*)	Static Pressure (*in. of water*)
Leaving kiln	1,250	—0.37
Leaving economizer	435	—3.5
Entering heat-exchanger	415	—0.25
Leaving heat-exchanger	230	—1.5
Entering filters	227	—2.5
Entering filter exhaust-fan	185	—5.62
Entering base of stack	182	—0.5

temperature above the dew-point of the kiln gas, thus avoiding any condensation. There is no present use for the heated atmospheric air from the heat-exchanger; it is merely discharged outside the building.

A pipe-line leads from the heat-exchanger to the filter building, where it is divided into three branches, each one leading to the inlet manifold of a 12-compartment automatic bag-filter. Pitot-tube measurements indicate a kiln-gas volume of 42,000 cu. ft. per min. at 240 deg. F., when operating the kiln at a rate of 1,500 bbl. a day. The filter medium is a pure woolen closely-woven fabric, which effectively prevents the passage of the dust particles. A completely automatic mechanism provides for regular and frequent cleaning of each compartment in

(*Continued on page 41*)

Silicosis and Other Dust Diseases With Which Industry Must Cope*

By C. O. SAPPINGTON, M. D.
Director of Industrial Health
National Safety Council

DUST has always been considered an important industrial hazard, but within recent years European experts have believed it to be an outstanding industrial problem. Although we have not made as much progress in these matters in this country, most authorities agree that our problems are really becoming apparent.

This brief survey of the various phases of dust as an industrial problem will be confined to five different headings: (1) Kinds of dust; (2) what happens to dust when it is inhaled; (3) silicosis; (4) methods of protection; and (5) legislation.

1. *Kinds of Dusts.*—It is important for us to remember that there are harmless as well as harmful dusts. When we say that a dust is harmful, we mean that it produces a fibrosis in the lungs, which means that an irritation is set up by the quality of the dust inhaled, this irritation producing fibrous tissue, or scars, which take the place of the normal lung structure.

Of course there are chemical dusts of various kinds, which if breathed into the lungs will produce systemic poisoning. There is no more rapid way to contract lead, mercury or arsenic poisoning, than by inhaling finely-divided particles of these metals, because the poisonous material is immediately taken into the circulation through the very thin and microscopic partitions in the air sacs of the lungs.

In addition to poisonous chemical dusts there are the so-called non-poisonous organic or vegetable dusts, such as cotton, jute, hemp, also sugar and flour, and others which could be included under this category. Such dusts as these may cause functional disturbances in the lungs, but, as far as we know, do not produce structural or organic changes. It is also well known that these dusts can be irritant to the skin and produce characteristic irritant eruptions in certain instances.

Of the inorganic or mineral dusts we have three types:

(a) The non-silica-containing dusts, such as coal and lime (of course there is a certain amount of silica in anthrocite coal, but in most bituminous coals there is relatively a very small amount of free silica).

(b) The combined silicates which, as the name signifies, are those compounds in which silica is in combination with other substances, typical examples of these being clay, talc, feldspar, and mica (up to about five years ago, most authorities agreed that no combined silicates produced fibrosis in the lungs; within recent years, however, there have been reports in the literature of cases of so-called asbestosis caused by the inhalation of finely-divided asbestos dust, which is chemically calcium-magnesium metasilicate. Also, within very recent years, due to the research of Dr. Leroy Gardner of Saranac Lake, it has been shown that carborundum or silicon carbide is also capable of producing a fibrous reaction when inhaled in finely-divided particles).

(c) Finally, under the heading of inorganic or mineral dusts is the classification known as harmful or free silica, the best known types of this class being silicon dioxide or sand, granite, quartz, and the different varieties of sandstone.

We can, therefore, make the following outline of the various kinds of dusts:

I. Poisonous (chemically)
   Lead, mercury, arsenic, and others.
II. Non-poisonous
   A. Organic — cotton, jute, hemp, sugar, flour, and others.
   B. Inorganic—(mineral)
      1. Non-silica dusts, such as coal and lime.
      2. Combined silicates.
         The orthosilicates such as clay, the metasilicates such as talc, and the trisilicates such as feldspar.
      3. Harmful silica, existing in the forms of pure silicon dioxide or sand, granite, quartz, and the various kinds of sandstone.

There is still some difference of opinion as to whether the various combined silicates and harmful silica itself can be considered non-poisonous. When this outline was made some years ago, it was thought that silica exerted its harmful influence purely by mechanical irritation. With recent years there has been some scientific evidence pointing to the fact that silica may exert its harmful influence because of its chemical attributes.

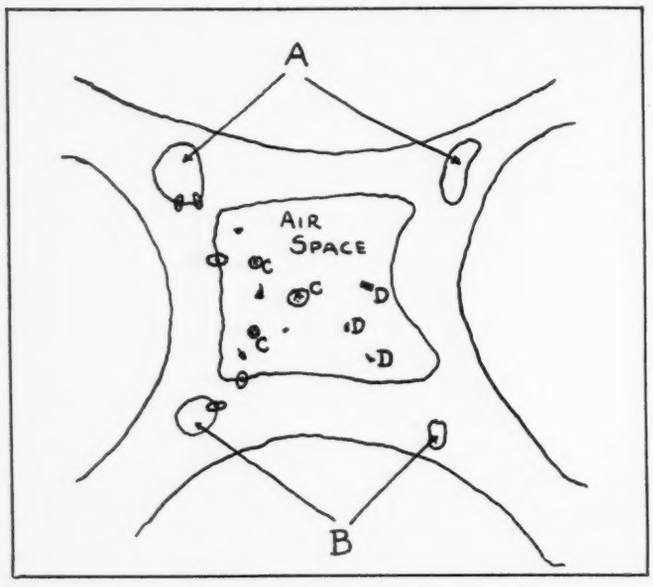
2. *What Happens to Inspired Dust.*—Here we are concerned only with particles which have a diameter of less than 10 micromillimeters. Since a micromillimeter is equivalent to 1/25,000 in., it will be seen that the particles which can cause trouble in the lungs are microscopic in size and can not be counted except by microscopic methods.

The sketch shows a typical air sac which has been magnified approximately 1,000 diameters. This is a cross-section of the air sac, showing the air space, and the walls of the air sac, within which are the lymph vessels (*B*) and the blood vessels (*A*). Note that there are some round cells which have gathered up particles of dust within them and also that there are free particles of dust in the air space. These round cells are called phagocytes,

* An address before the Engineering Division of the Chicago Safety Council.

meaning that they are devouring cells. They actually surround foreign material and engulf various kinds of foreign particles which may enter the air sac. These cells then migrate through the wall of the air sac and through the wall of the blood vessels and the lymph vessels and are carried by the blood and lymph streams to various portions of the body.

We are particularly interested in what happens to the cells which enter the lymph stream, especially in the case of the lungs, because at various points along the course of these lymph vessels, there are interposed sets of lymph glands, which strain out the phagocytes and the foreign material. In doing this they become enlarged, and in a great



Schematic diagram of lung cell showing engulfing cells migrating to blood and lymph vessels. A—blood vessels; B—lymph vessels; DDD—dust particles free in air space.

many instances these cells disintegrate, leaving free silica in the glands, which then undergo fibrosis. This is what makes them visible in X-ray pictures, because of the increased density resulting from the formation of fibrous tissue.

A number of theories have been held as to the actual cause of the fibrous reaction in the lungs. Mavrogordato first held that it was the quality of inspired dust and not its quantity which was the chief cause of a fibrous reaction. A little later Collis proved by microscopic anatomical studies that the devouring cells actually plugged the lymphatic vessels and the glands at the roots of the lungs. So great is the stoppage of these vessels that they back clear up into the lung tissue proper and there disintegrate, leaving the free silica which, because of its peculiar characteristics, is not absorbed as other dusts are. Being a constant source of irritation, a serum is poured out and finally changes to fibrous tissue. This is a characteristic reaction which takes place in any part of the body where a foreign material is not absorbable and produces an outpouring of serum which is eventually changed to fibrous strands.

More recently Hefferman advanced the idea that the chief reason why silica produces a fibrous reaction is because it is a colloid in structure, a colloid being a material which will not pass easily through an animal membrane or cell wall and is distinguished from the crystalloids which are soluble in body fluids and thus pass easily through membranes or cell walls and may thus be finally excreted by the fluids of the body.

Pneumonoconiosis is the scientific name applied to all types of dusted lungs. There are specific kinds of pneumonoconiosis, silicosis being a particular kind caused only by the breathing of free silica to an amount to produce fibrosis. Abestosis is another form of pneumonoconiosis. Anthracosis, a very common type, is due to the inhalation of coal or carbon particles—most city dwellers have this type of pneumonoconiosis, which is not considered strictly speaking a real pathological change.

3. *Silicosis.*—It is well to repeat that silicosis is caused by the breathing of harmful amounts of free silica, which eventually produces a fibrous change in the lungs, replacing the normal lung structures.

There are four important points in the production of silicosis:

1. Particle size.
2. Number of particles per cubic foot of air.
3. Mineral composition of the dust.
4. Length of exposure.

We have already commented on the particle size, stating that it is only particles of less than 10 micromillimeters in diameter that can cause trouble, because only these can get into the lungs.

The number of particles per cubic foot and the mineral composition of inspired dust can be considered together. These two factors have a distinct relationship to each other and this relationship is indirect, meaning that a safe concentration of dust will reach a higher number of particles per cubic foot when the silica content of the dust is low; contrariwise, when the silica content of the dust is high, a safe concentration of particles will be correspondingly lower. Let us illustrate this general statement: if the silica content of any given dust is 35 per cent., the standard of safety can be placed at approximately 15,000,000 particles per cu. ft. of air in the breathing zone of the workman. If we reverse this situation and consider a dust which has a silica content of 70 per cent., then the margin of safety will be approximately 7,500,000 particles per cu. ft. of air. When you reach 90 to 100 per cent. of free silica, as in sand-blasting, the standard is placed at approximately 6,000,000 particles per cu. ft. of air.

Our ideas concerning the length of exposure in the development of silicosis have undergone a change within recent years. It was formerly thought that 10 yr. was about the average exposure in the cases of silicosis which had developed. It is now known that a great number of cases of silicosis have developed in much less than 10 yr. of exposure. For instance, in some of the Canadian silicosis laws, before a man can get compensation, it is required that he show a minimum of 3 yr. exposure in stone-cutting occupations, and a minimum of 5 yr. exposure in other occupations. This would

tend to show that the average time necessary for the development of cases of silicosis is very much less than 10 yr. There are cases on record where employees have developed silicosis within a period of 2 yr., within a period of 1½ yr., and, in certain rare circumstances, even under an exposure of 1 yr.

It must be remarked that not all persons are alike in the rapidity with which they develop silicosis under similar conditions of exposure. However, there is no immunity, natural or acquired, by which any individual may feel that he is entirely safe from contracting silicosis, if exposed to conditions which ordinarily produce this disease.

Neither is there any known way, by which a person may be freed of silicosis after he has developed it. One of the important points about silicosis is its progressiveness. After a victim has reached the third stage and, in some instances, the second stage, the disease goes on to a fatal termination, even if the employee has been removed from further exposure. This is called a "progressive" type of lung pathology.

Three stages are recognized: (a) the so-called ante-primary, (b) the primary, and (c) the secondary. These names were given to the various stages through the British experience in South Africa, which has finally come to be a model for all other countries.

(a) In the ante-primary stage there may be no other symptoms than those of a common cold. The physical signs may be quite indefinite and not characteristic. Usually, however, there is some diminution of chest expansion and some shortness of breath on exertion.

(b) In the primary stage there is more diminution of chest expansion, more shortness of breath on exertion, and the chest findings are indicative of definite lung disease. The X-ray picture quite frequently shows an enlargement of the glands at the root of the lungs, with an increased amount of fibrosis, an extension of the lineal markings out beyond what is called the "periphery," and a beaded appearance of these bronchial markings caused by the laying down of fibrous tissue, and collections of devouring cells.

(c) In the secondary stage, which is the final stage of silicosis, there is considerable disability due to the increased diminution of lung expansion and shortness of breath on exertion. There may be cough and some sputum. The X-ray findings are quite definite now and are characteristic, showing an infiltration over the entire middle portion of both sides of the lungs, with what is known as a coarse mottled or "snowstorm" appearance.

We have to keep in mind always that any case of silicosis may be complicated by tuberculosis; in fact, in a certain number of instances the terminal picture is one of silico-tuberculosis or pure tuberculosis.

Post-mortem findings have consistently shown that there are small nodules of fibrous tissue formed in advanced cases of silicosis. In such cases even particles of very fine sand are present. This is not a new finding, it having been demonstrated by Ramazzini, as far back as the year 1700.

4. *Methods of Protection.*—In considering methods of protection it is wise to mention that the National Safety Council in conjunction with the U. S. Public Health Service has just completed a field study relating to the health hazards of sand-blasting processes in industry. Briefly, surveys have been made of various types of sand-blasting equipment, protective apparatus, and other relative factors. Dust counts have been made, showing the exact number of particles per cubic foot of air under various conditions. Petrographic analyses have been made showing the exact percentage of free silica under certain conditions, and medical histories, together with X-ray findings, have also been developed. It is hoped that, through this study, certain standards can be suggested for the safe conduct of sand-blasting processes, which will form a definite step toward the protection of workmen in these occupations.

So far, the best method of protection, as far as respiratory apparatus of each exposed employee is concerned, is the positive-pressure hose mask. Together with this, it is often necessary to use properly equipped and maintained systems of exhaust ventilation.

In addition to these methods, special housing, in the form of cabinets and barrels, and sand-blast rooms have also been found valuable. It is very important, however, that such inclosures should not only completely house all apparatus, but should be built in such a way that the dust concentration will be kept down to a point which is compatible with healthful working conditions.

In the experience of most companies it is impossible adequately to protect such workmen without periodic medical supervision. This takes the form of periodic examinations, together with X-ray pictures, on employees who are already working, and also a very painstaking employment examination, and history, which will show the employee capable of working under such conditions.

5. *Legislation.*—It is interesting to note that in three provinces of Canada—Ontario, Saskatchewan and Quebec—there are silicosis laws, which provide for the protection of workmen in industries where such processes are commonly used.

The Ontario law may be taken as an example. To carry out the various procedures necessary, a silicosis commission, composed of three expert physicians, has been appointed. It is the duty of this commission to make employment examinations of all persons entering industries where there is a silicosis hazard, to make periodic examinations of all persons so employed, and to rate persons who have contracted silicosis.

The Ontario law provides that there must be from 3 to 5 yr. exposure, 3 yr. in stone-cutting trades and 5 yr. in other industries. In the ante-primary stage, showing the earliest detectible physical signs of silicosis, which have been or are present, a lump sum of $500 is awarded, whether or not the capacity for work is or has been impaired. In the primary stage, where physical signs are more constant and

radiographic changes are also more characteristic, there is an impairment which is usually not serious and permanent; for this stage a lump sum of $1,000 is awarded. In the secondary and final stage of silicosis, where the findings are rarely unmistakable, the impairment is considered serious and permanent and the employee is awarded two-thirds of his wages for the rest of his life.

Although the laws in Saskatchewan and Quebec are not exactly the same, they are very similar and in these other instances are administered in a similar way.

There are six states in the United States which have complete occupational disease coverage: California, Connecticut, Maryland, Massachusetts, North Dakota, and Wisconsin. Hawaii is also included.

It is interesting that Illinois enumerates the dangerous processes for which compensation will be paid, if the claim is justified. These include processes involving lead, arsenic, brass, and zinc.

Virginia Leads in Production of Slab and Block Soapstone

(Continued from page 26)

terior trim, wainscoting, spandrels, and exterior trim. Two other important architectural uses, stair treads and floor tile, are the principal outlets for the hard grades. The use of soapstone in combination with marble and other decorative stone is being actively promoted at present. The greatest possibility for expansion of soapstone production is generally acknowledged to be through the increased use of the stone for various architectural purposes. In fact, at present soapstone logically should be included in any discussion of the dimension-stone industry. The volume of production is small when compared with other more common building stones, but in its particular field soapstone is of noticeable importance.

The high diëlectric strength of soapstone, combined with its uniform texture, low absorption, freedom from metallic veins, resistance to flame action and high mechanical strength, makes it an especially desirable material for electrical insulation. Here again, however, the advantage of easy workability must not be underestimated, for the rapidity and accuracy with which soapstone can be machined undoubtedly is directly responsible for much of its popularity among electrical manufacturers. It is used for switchboards, panels, barriers, bases, circuit breaker compartments, insulating floor slabs, battery-room shelving or flooring, and for other related purposes.

The high heat-retention properties of soapstone led to its use as potstones and cooking utensils by both the Indians and the early American settlers. Until the last few years an appreciable part of soapstone production was utilized in the manufacture of griddles, fireless cookers, oven floors and grates, footwarmers, snow melters, and hearths. At present, however, more modern contrivances have supplanted most of these products, although soapstone still is being used in large commercial traveling ovens and electrical fireless cookers.

When heated to a temperature of about 1,800 deg. F., some grades of soapstone turn to a golden brown color and become so hard that they can not be scratched with an ordinary knife. Considerable research work has been done in attempts to utilize this property commercially in the production of floor tile or decorative stone for use where hardness and durability are important factors. Results obtained in using the material have been entirely satisfactory, but manufacture is difficult. The principal constituent minerals of soapstone contain water of crystallization which is driven off at varying temperatures, depending upon the exact composition. In order to avoid cracking while the soapstone is being heated, the temperature must be held constant for several minutes at the critical point or points of the particular sample. Obviously, in mass production with varying critical temperatures this is impracticable and, as a result, in the manufacture of such tile a heavy loss is incurred because of fracturing.

A modification of this same principle which apparently has possibilities is heating or soapstone dust, the resultant product to be used as an abrasive. Various grades and sizes could be produced.

Only an insignificant part of soapstone waste is now being utilized profitably. Small quantities of irregularly broken slabs are used locally in landscaping as stepping stones or for rock gardens. The isolated location of the deposits prevents extensive development of this market possibility.

The only outlet for waste soapstone of any appreciable size or importance is in pulverized form. Ground soapstone has been used for a variety of purposes in direct competition with other pulverized rock, including the lower grades of talc. It does not compete with high-grade talc, especially for uses in which color is an important factor. At present the rubber and roofing trades are the largest consumers. It is used principally for dusting raw or processed material in various stages of manufacture to prevent sticking, although it is reported that some of it may be used as a filler. Considerable quantities are exported; one large rubber company in Singapore using it for dusting raw rubber to be shipped into this country. Much of the tire powder used to sprinkle between casings and inner tubes is ground soapstone.

The use of admixtures in concrete has attracted much attention during the past few years. Numerous products have been introduced, for all which increased workability and denser concrete are claimed as their principal advantages. Ground soapstone has been used successfully for this purpose, but no attempts have been made to promote its distribution on a large scale.

The manufacture of floor tile made of ground soapstone, sawdust, and Portland cement, appears to be worthy of further research. This type of flooring combines resilience and durability, and it is especially adaptable to industrial buildings. Its commercial development no doubt would stimulate production of ground soapstone.

Some Basic Requirements in Preparing

A Purchase Specification for Ready-Mixed Concrete*

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THE status of concrete has materially changed in the last few years. It is no longer exclusively a job-made product, but has become also a factory-made product, produced by an organization independent of either the contractor who uses it or the engineer who specifies it. This situation has made necessary an entirely new type of concrete specification, one which deals with concrete as a building material, ready to use when delivered to the job. Thus, a demand has grown up for a standard specification under which concrete can be purchased as is steel or brick, and which has the same standing and authority with engineers and architects as do the standard specifications for these materials.

The natural approach to the problem of preparing a purchase specification for ready-mixed concrete is to take one of the accepted present-day specifications for job-mixed concrete and modify it to suit the newer product. Such a procedure is sound insofar as ready-mixed concrete is subject to the same fundamental laws of physics and chemistry as all concrete, but in so doing there is the danger that the modified specification will, figuratively speaking, carry a whip socket on the dash as did the early automobiles, and hence every requirement written into the new specification should be examined critically to see whether it is or is not one that is applicable or necessary in the present case. Also, it should be remembered that the ideal specification fully protects the consumer without unnecessarily interfering with or hampering the producer, and every requirement should be examined also from this standpoint.

A concrete specification falls naturally into nine divisions: (1) General clauses; (2) materials; (3) proportions; (4) consistency; (5) measurement; (6) mixing; (7) delivery; (8) inspection; and (9) tests and acceptance.

1. *General Clauses.*—Under the first division comes such general items as (a) scope and limitation of the specifications, (b) the definition of ready mixed concrete, and (c) any other matters of similar nature. It should not, however, include items dealing with questions such as damages arising from failure to maintain deliveries, payments and terms, and other matters that form part of the usual contract between buyers and sellers of merchandise or services.

2. *Materials.*—The materials to be dealt with under this heading are (a) cement, (b) aggregate, (c) water, and (d) admixtures. The first two can be disposed of briefly by references to the existing standard specifications of the American Society for Testing Materials, and water can be covered by requiring it to be fresh and free from deleterious impurities.

Admixtures are not so easily handled. Most engineering and architectural specifications permit the addition of admixtures only when specifically authorized. On the other hand, many operators of central-mixing plants have found that, under certain circumstances, an admixture helps them to deliver a better concrete. To forbid entirely the use of admixtures would hamper these particular operators, but to allow their use indiscriminately would bring the specification for ready-mixed concrete in conflict with the majority of present concrete specifications, which would seem to be unwise. The author's own view of this dilemma is that it would be best to specify that admixtures may be used with the permission of or on the instructions of the buyer, leaving it to the operator who wishes to use them to convince his customer that they are needful and beneficial.

3. *Proportions.*—In the concrete industry the term "proportions" has come to have two meanings, the first referring to quality, the second to the quantities of the different materials required to produce a unit volume. While, strictly speaking, the first usage is not correct, the relation between quality and the quantity of the ingredients used is so intimate that it is convenient to discuss both under a single heading.

The quality of concrete is usually specified in one of several ways: (a) by arbitrarily-set proportions, (b) by cement content, (c) by water-cement ratio, (d) by compressive strength at some given age, or (e) by a combination of these to which should be added a reference to the consistency of the concrete when delivered.

When arbitrarily-set proportions are used as a measure of quality, the only problem which the producer has is to determine the equivalent batch quantities and, to provide for this, the specification should include a clause stating exactly what is meant by a cubic foot of cement or aggregate. The common practice is to consider that a cubic foot of cement is equivalent to one sack weighing 94 lb. net, and that a cubic foot of aggregate is equal to its unit weight when tested dry, in accordance with the standard methods of the American Society for Testing Materials.

* Presented at Second Annual Convention, National Ready-Mixed Concrete Assn., Pittsburgh, Jan. 25 and 26, 1932.

When any of the other three methods of stating quality are used, it is left to the producer to design a mixture that, with the proper consistency, will either have the required cement content or water-cement ratio or produce concrete having the specified strength at the age set. At once there arises the question of how far the producer shall be allowed a free hand in determining the mixes that will meet the requirements for quality. All producers do not have the necessary knowledge to allow them to design concrete mixtures, but this is almost equally true of engineers and architects. There is, besides, the temptation to design the cheapest mixture that will "get by." It would seem, therefore, that some safeguards should be set up.

When the quality of concrete is defined by its consistency and either its cement content or water-cement ratio, or both, the minimum amounts of cement and water which the producer is likely to use are established within fairly narrow limits. It is improbable that the producer will use more cement than the minimum unless it is necessary to do so to meet the consistency requirement or the combined water-cement ratio and consistency requirement. In this case the only safeguard required is to prevent the producer from using too little or too much fine aggregate. This can be prevented quite simply by a clause, such as has been used in a number of specifications, stating that the quantity of fine aggregates in any concrete mixture shall not be less than one-third or more than one-half of the total aggregate used.

When concrete quality is specified in terms of its compressive strength at some age there are added complications. It is necessary to state just what is meant by a certain strength at a certain age, and on what basis the concrete must be designed to assure the buyer that the specified strength will be met. There is also the question of determining what constitutes performance in meeting the requirements but this, however, will be discussed later, under *Tests and Acceptance.*

The question of how the specified strength shall be defined is logically taken care of by referring to the standard methods of testing concrete that have been developed by the American Society for Testing Materials, and stating that — lb. concrete shall have a minimum compressive strength of — lb. per sq. in. at — age when made, cured, and tested in accordance with the standard methods of the American Society for Testing Materials, leaving it to the engineer or architect to determine the relation that should exist between these requirements and working stresses, durability, fire resistance, and the like.

There are data by which a producer of ready-mixed concrete can design a strength concrete with reasonable assurance of meeting the requirements, but the most exact way is for him to have tests conducted on his own materials and base his designs on these tests. It seems to the author that it is hardly reasonable for a producer to ask a buyer to have confidence in his ability to meet a strength specification if he has not found out for himself what his raw materials will do. On this basis, the author would be inclined to require that designs for strength-specified concrete be based on actual tests of the producers' materials or equivalent data obtained during operation.

Building codes usually require that, when concrete is designed on the basis of water-cement ratio and strength, the actual strength used in determining the proportions must be 15 per cent. greater than the minimum required by the code. This requirement should be included in the specification for ready-mixed concrete, not only because it is a wise provision, but because a very considerable volume of concrete is sold subject to building code requirements.

There are many ways of determining the actual proportions necessary in any given case: by voids, water-cement ratio, mortar voids, trial and error, and so forth, and it would be difficult to include all these in a specification without making it too long and cumbersome. It is unfortunate that these methods have not been codified by the American Society for Testing Materials or the American Concrete Institute, as such a document would not only be of considerable assistance to the average ready-mixed concrete operator, but could advantageously be referred to in such a specification as is under discussion.

No matter by what method the proportions are obtained, the batch quantities will be determined first in terms of dry aggregates and the total amount of water required. The specifications should require that before these may be used in batching, they shall be corrected as necessary for the natural moisture contained by the aggregate.

4. *Consistency.*—Workability is one of the basic properties required of a concrete mixture. It is also the one of most immediate concern to the user and the one over which there is as much argument as any between user and producer. In practice workability is referred to as consistency, and is usually measured by the slump test. So far, no better field method has been devised for this purpose than the slump test, and while it admittedly has many and serious limitations, it is sufficiently reliable and definite for the class of concrete mixtures generally used in the ready-mixed-concrete industry, to be made a part of a specification. It is the author's suggestion that, in the specification for ready-mixed concrete, the average slump of each class of concrete should be definitely stated, that reference be made to the standard method of determining slump adopted by the American Society for Testing Materials, and that a tolerance of, say, 1 in. above and below the average slump be allowed to take care of minor variations in the consistency of the concrete and the known inaccuracies of the test.

5. *Measurement.*—The weighing of aggregates has become almost universal practice in ready-mixed-concrete plants and its proved advantages make it a desirable requirement in a ready-mixed-concrete specification.

While certain authorities feel that measurement of the cement by weighing is not so essential, since

the sack of cement is a definite unit, the author is of the opinion that weighing of the cement should also be required. Cement should always be weighed in a separate hopper from that in which the aggregates are weighed.

Mixing water can be accurately measured either by weight or volume, and the proper provision here would be to insist that, whatever the device, its readings be accurate within, say ½ to 1 per cent. For truck-mixer operations the measurement of water in the water-tank mounted on the mixer should, in the author's opinion, be forbidden. Instead, the proper amount should be measured at the plant at the same time the cement and aggregates are batched and the measured water then run into the truck-tank when the mixer is being loaded.

The producer of ready-mixed concrete should, for his own protection, have his plant equipped with accurate weighing devices and the specifications should so require. It may be argued that this is a detail with which the buyer is not concerned if he gets the required volume and quality of concrete, but since the best assurance the buyer has that both these requirements are being met is by plant inspection of the batch quantities, he is justified in insisting on the accuracy of the weighing equipment. This feature can be taken care of by specifying that all weighing equipment meet the requirements for Weighing Devices for Concrete Aggregates of the American Road Builders Assn.

6. *Mixing.*—Any specification for mixing must take into consideration the two different systems used by ready-mixed-concrete plants; namely, (a) mixing at the plant, and (b) mixing in transit.

The first system differs in its requirements from the standards found necessary for job-mixed concrete, only in that the central-mixing plant usually uses mixers of much greater capacity than are found in job plants. The same safeguards that experience has found desirable for job mixing should be required for central-plant mixing, and some sliding scale of mixing time, increasing as the capacity of the mixer increases, should be included to provide for the slower mixing action of large mixers. The author would suggest a minimum requirement of 1 min. for mixers of 1 cu. yd. capacity and less, increased by ½ min. for each additional cu. yd. or less of capacity.

The truck-mixer is somewhat more difficult to provide for in a specification than a stationary mixer, because it is not so well standardized, and information on the performance of different types is meager. The drum should be water-tight when closed; it should have a total volume of at least twice its wet-batch capacity; and it should be driven at the proper speed. The proper mixing time is harder to specify for it varies not only with capacity, but with different types of mixers, and the differences between them are so great that it would be difficult to set a mixing time that would be safe for all, and yet be fair to the more efficient. Some study must be given to this point before definite limits can be set.

7. *Delivery.*—Here again the requirements are somewhat different for the central-mixing plant from those for truck-mixer plants. The author has had little experience with the former and does not feel competent to suggest what clauses are necessary in the case of this type of operation, but general experience seems to indicate that low-slump concrete can be successfully transported in non-agitating bodies, but that for slumps above 2 to 2½ in. agitating-type bodies are necessary.

A question that has troubled many engineers and architects when asked to permit the use of ready-mixed concrete is, "What length of time should be permitted between the mixing and the placing of the concrete?" It would appear from tests made that the strength of concrete is not materially reduced even if it is not placed for as much as 3 hr. after mixing, but the consistency of the wet mixture, as measured by the slump, is reduced greatly. The Tentative Specifications for Ready-Mixed Concrete of the American Concrete Institute suggest that the elapsed time between the addition of the cement to the aggregate and the placement of the concrete in the forms be not over 1 hr. This limits the time that may elapse between the charging and the discharging of the delivery unit to about 40 min. The author is inclined to the view that the elapsed time could safely be increased to 1¼ hr. or 1½ hr. As hauls which limit truck equipment to one trip every 2 hr. are seldom profitable, there is little likelihood that the producer will use this additional time to increase the average haul. More likely it will save for him certain loads that are delayed in transit or held on the job, that are entirely suitable for use, but are now returned.

When concrete is delivered by truck-mixers, the same question of elapsed time enters, but in a slightly different way. Some operators add the gaging water to the mixer just before mixing, in which case the only moisture in contact with the cement prior to this time is the moisture contained by the aggregates, other operators put the gaging water into the drum with the rest of the batch, and some combine these systems. Most engineers will argue that the limiting time specified for delivery of central-mixed concrete should apply here, and this view will probably prevail when specifications are written, but when the bulk of the water is not added until the batch is mixed, 2 or 3 hr. can elapse between batching and mixing with little or no detriment to the quality of the concrete. Where the bulk of the water is added with the batch, the same restrictions for elapsed time that apply to central-mixed concrete would apply to truck-mixed concrete.

A great deal of concrete is now placed during the winter months. Years of experience with job-mixed concrete has taught most engineers and architects to specify that the aggregates and water are to be heated during this period, and the temperature of the freshly-mixed concrete held between some such limits as 50 deg. and 120 deg. F. It seems to the author that, for ready-mixed concrete, the only provision needed is that the concrete when

delivered shall fall within a certain range of temperature to be set by the buyer and he would suggest for consideration 60 deg. to 80 deg. F. for temperatures down to 25 deg. F. and 75 to 95 for all temperatures below this.

The maximum rate at which delivery is to be made by the producer is one which should be a matter of agreement between him and his customer, and the best place for such a clause is in the contract proper rather than in a specification for quality. Some limiting time between successive batches is a restriction thought desirable by many.

8. *Inspection.*—The buyer of concrete should have the same right as any other purchaser of material or equipment freely to enter the plant of the producer and examine and test the raw materials and the different processes that enter into its manufacture. The cost of this inspection should be borne by the buyer and not by the producer.

Certain specifications for ready-mixed concrete require that the producer's plant shall be under the direct supervision of a competent engineer. Unquestionably, it would benefit the industry if every plant had an engineer familiar with concrete technology responsible for the quality of the product, but so would the foundry business if every foundry had a metallurgist in charge, or the clay-product industry if every brick and tile plant had a ceramist in charge. It seems to the author that one is on questionable ground when one includes this requirement in a purchase specification for it is hardly enforceable, as it leaves to the buyer the decision as to who is or is not a competent engineer in this line of work, and if there is any doubt in the buyer's mind as to the ability of the producer to meet the specification, he should not buy from him.

9. *Tests and Acceptance.*—These two subjects are so intimately related that they can best be discussed together for the same principles govern the requirements of both. The buyer purchases ready-mixed concrete to be delivered to some designated location, and it is his right to demand that the concrete should meet the requirements of the specification when and where delivery is taken.

The producer is responsible for the quality of the concrete only up to the time of delivery, for he has no control over the concrete after the buyer receives it, and the latter can entirely alter its properties by his treatment of the concrete subsequent to the time it leaves the producer's hands.

For these reasons it would seem to be desirable and necessary to base all tests and acceptance on the condition of the concrete at the time and place of delivery. The concrete should be sampled and slump tests made then, and not of the concrete in the forms. The supervising architect or engineer will probably require that his samples be taken from the forms and it is here that difficulty is likely to arise for tests are not likely to be made at both points and, in case of argument, the producer either must accept the former's tests or prove that the concrete has been abused. In order to protect themselves in case of dispute many producers have independent inspection companies sample and test their concrete at the point of delivery and, while the practice can hardly be made mandatory, the producer who does so is wise.

The buyer of ready-mixed concrete has a right to insist that the product he receives shall meet the specification in all particulars and, if it does not, he need not take it. But who shall decide when the specification is met? Certainly not the seller, nor has the buyer any more right to insist that his decision shall govern. There should be some way of definitely determining performance independently of either parties to the contract.

The buyer, under the inspection provision of the specification, has the right to sample and test the ingredients going into the concrete, he has the right to inspect the various manufacturing processes, and in both cases, if they do not conform to the specification, he has demonstrable facts to deal with in case of an argument. When it comes to the question of the quality of the finished concrete, there is more room for differences of opinion. As stated previously, quality is usually given in terms of consistency, and either proportions, minimum cement content, water-cement ratio, compressive or flexural strength, or some combination of these. Consistency is measured by means of the slump test and presents no difficulty. The compressive or flexural strength can also be measured if one will await the time required to cure the test specimens, but, after a concrete is mixed, about the only possible way in which the proportions or cement content can be determined is by some system of unscrambling the wet concrete. It is the author's belief that some such test must be included in the specification as one of the acceptance tests.

For determining the proportions from a sample of wet concrete a test which has possibilities for this purpose has been developed by Prof. Dunagan of the University of Iowa and is now being studied by the American Society for Testing Materials. This test has as yet been used for so short a time that data with which to determine the proper tolerances that should be used with it are lacking, but a little experience will remedy this deficiency. The same test could be used to determine the cement content of a freshly-mixed concrete, but here again tolerances would need to be established. When the concrete in question has set, there is another test which is also being standardized by the same society, and for which also tolerances must be determined.

The Dunagan test might be used as well for determining the water-cement ratio of a concrete mixture, for it is claimed to measure the water in a mix to $\frac{1}{10}$ gal. per sack of cement, and to be reliable to $\frac{1}{4}$ gal., which, in terms of water-cement ratio, work out to .015 and .038 respectively. For specification purposes a test for water-cement ratio should determine it to an accuracy of $\pm$ .03 which is equivalent to approximately $\pm$ 150 lb. per sq. in. at 28 days. If the Dunagan test is as accurate as claimed it practically meets these requirements.

In addition to this it is necessary to give the pro-

ducer some leeway in the water content of his concrete. Just what this should be the author is not prepared to say, but would suggest for study that the average water-cement ratio of the concrete delivered should not be less than the minimum specified and that any one batch of concrete tested should not fall below this minimum by more than .05.

Much concrete is now sold on a so-called strength specification. Such a specification appeals to many buyers as a simple way of shifting to the producer the responsibility for determining the proper proportions required to give the compressive strengths wanted by the engineer or architect, and it appeals to the producer since it gives him a greater opportunity to profit by his knowledge of concrete and a careful selection of the raw materials. The great drawback to this form of specification is the difficulty of determining whether or not the producer has actually delivered concrete of the specified strength, and most specifications are very hazy on this very important point. The measure of performance for this kind of specification is the test of a hardened specimen of the concrete delivered, and this test is usually made from a week to a month after the concrete was built into the structure. The question always arises, "What happens if these tests do not meet the specifications?" Of course, if the concrete actually does not meet the specification, the purchaser may require its replacement, but this is such a costly procedure for both producer and purchaser that if there was any general likelihood that such an event was probable, few men would enter into this type of contract. The fact is that with any well-run concrete plant it is a very remote eventuality, and the principal danger from this type of contract is that some accidental condition will affect the tests adversely and the quality of the concrete will be questioned. If this happens and the buyer or the buyers' engineers are unfriendly or uninformed and the producer is unfortunate in not having protected himself by independent tests of his product and a proper understanding with the buyer of what he has contracted to do, he may have a very expensive and nerve-racking experience.

A purchase specification for ready-mixed concrete should cover these eventualities by definitely stating:

(a) Where and when the concrete is to be sampled.

(b) How the test specimens are to be made, cured, and tested.

(c) When the tests indicate that the specification is met.

(d) What procedure shall be followed in case the tests indicate the specification has not been met.

a. The first point has been covered earlier in this discussion, when it was required that samples should be taken at the time and place of delivery of the concrete.

b. The second is covered if all tests are required to be made in accordance with the standard methods of the American Society for Testing Materials with the added provision that all test specimens are to be laboratory cured under standard conditions after the first 48 hr., and that the provisions in no case apply to so-called job-cured specimens.

c. When do the tests indicate that the specification has been met? The obvious answer is "When all the tests are above the specified minimum." This may be the obvious and logical answer, but it is likely to be uneconomical and unfair.

The science of testing concrete is far from being exact, and a group of identical specimens made by skilled men in a well-equipped laboratory seldom have a mean variation from their average of less than 5 per cent., and often much more. Also, practically all the errors in carrying out the provisions of the standard methods of making, curing, and testing concrete give test results lower than the true values. For these reasons a producer of ready-mixed concrete who must comply exactly with the foregoing interpretation would need to design his concrete by such a wide margin that there would be absolutely no chance of failure. A reasonable margin of safety should be allowed in designing concrete mixtures and the 15 per cent. required under *Proportions* is expected to do this, but even this does not always provide for the accidents of testing. Therefore, it seems to the author that a tolerance should be adopted something after this character:

"The average compressive or flexural strength at 28 days or other age specified shall not be less than the minimum required by the engineer or architect," and in order to provide for the accidental low test it should be added that "the requirements of the specification shall be considered to have been met if not more than 10 per cent. of the tests fall below 90 per cent. of the specified minimum."

Study of test data may show that other percentages or requirements should be used, but the author's experience would indicate that the above could be easily met by a well-handled concreting operation either ready-mix or job.

d. The last question is "What procedure shall be followed in the event that the tests indicate the specification has not been met?" This contingency is most likely to arise when there is some question as to the correctness of the tests or there is a discrepancy between the producer's and the buyer's tests. The producer should have the right, if he wishes, of obtaining cores of the hardened concrete in place. The buyer may argue that the concrete is older than the test age mentioned in the specification and there may be some doubt in the producer's mind as to how thoroughly the concrete has been cured. The producer should be able to insist on proper curing before samples are taken and the specification should state the field strengths that will be considered equivalent to the specified strengths at different ages. Sampling of the concrete should be done according to the standards of the American Society for Testing Materials, and the contract should state who pays for the tests.

If the tests fail to meet the specification and the structure is a building, the producer, if he so desires, should be allowed at his own expense to test

the suspected section under the provisions of the building code, and if the structure meets these tests, the requirements for quality shall be considered to have been met. If the structure fails to meet the building code requirements due to the quality of the concrete, the producer should be required either to make the structure good or pay damages to the amount suffered by the purchaser. The contract, rather than the specification, should provide for these eventualities.

The producer who accepts orders for concrete under any specification can not escape the consequences if he fails to live up to his contract, but the producer who undertakes to deliver concrete to a specified strength assumes special risks, and he should never forget that fact, and should be certain beyond any doubt that his organization has the requisite knowledge, skill, and equipment to carry out its obligations. He also should take all reasonable means of protecting himself against the ignorance or inefficiency of the other parties to the contract. Having done both these things, he may feel confident that the likelihood of failure is too remote to be a serious hazard to his business or reputation, but failure to observe these simple precautions may and has been the cause of serious losses in the past, and will be again in the future.

One other item that should be included under *Tests and Acceptance* is a statement of how the volume of a batch of wet concrete is to be determined. The simplest method is to consider it the sum of the absolute volume of its ingredients, and for the majority of concrete mixtures the volume calculated in this way should agree with the measured volume within 1 per cent. For very lean concretes, for lean mortars, and for concretes made of very porous aggregates such as cinders or haydite, the calculated volumes are not reliable, due either to the presence of a varying amount of air voids in the concrete or to the difficulty of determining the proper specific gravity of the aggregates. For these conditions, the correct volume of any batch may be determined by calculating the weight per cubic foot of the concrete from the weight of test cylinders at the end of 24 hr. Volumes determined in this way will check within 1 per cent. with calculated volumes, when the mixtures used are free from air voids. It would probably be found satisfactory, if the specifications for ready-mixed concrete allowed either method of determining volumes to be used, with the provision that, if the calculated volume differs more than 2 per cent. from the volume determined by weighing the test cylinders, the latter should govern.

Unburned Magnesite Refractories in Rotary Cement Kilns

A refractory having a basic chemical reaction is desirable for use in the rotary kilns used for burning Portland cement, according to A. E. Fitzgerald, ceramic engineer of the General Refractories Co. However, due to intermittent operation of equipment and the low spalling resistance of burned magnesite brick, these industries have been unable successfully to use burned magnesite. Unburned magnesite brick, because of its high resistance to spalling, has made available to these industries a suitable refractory of the desired basic character.

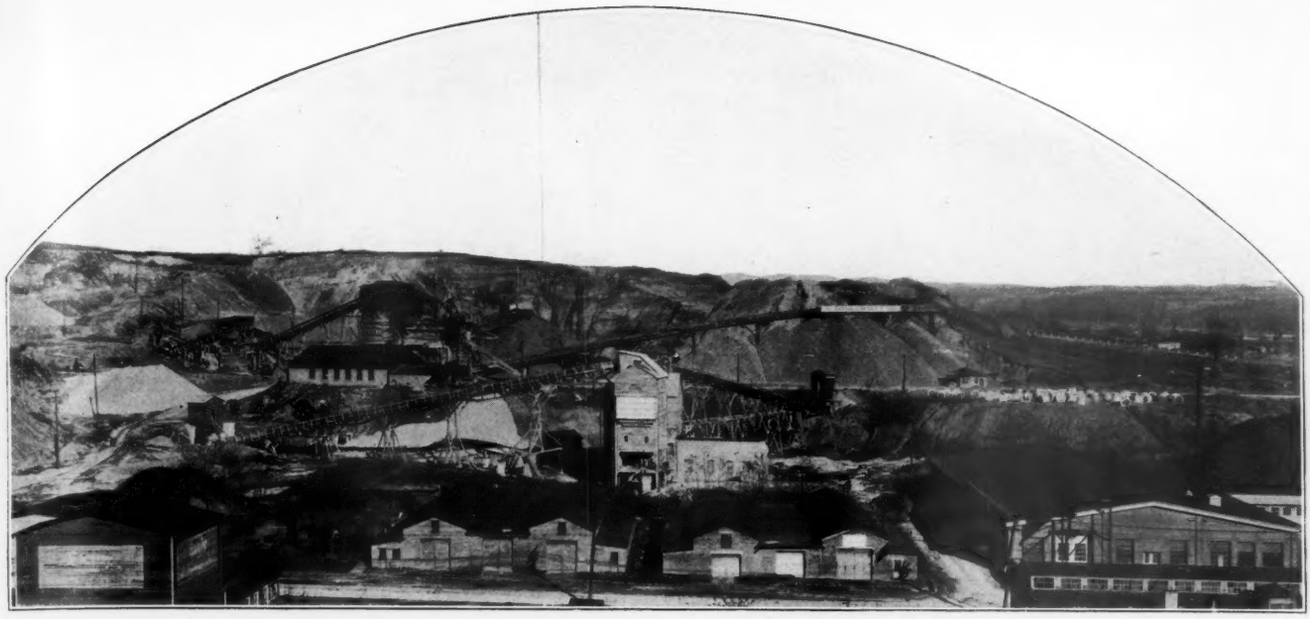
In the Portland-cement industry, the failures of rotary kiln linings can often be traced to two reasons: First, the refractory may crack or spall and allow the coatings to fall in. This may be due to the use of improper brick, which at kiln temperatures is badly vitrified by the action of cement clinker or merely to the brick's inability to withstand the heating and cooling encountered in normal shut downs. Second, the operating temperatures may be sufficiently high actually to melt the compounds formed through the union of cement clinker and the refractory lining. When this occurs, the protective kiln coating built up on the brick actually slides away from the brick. For years ordinary fireclay brick answered the requirements of the cement industry, but eventually service conditions increased in severity and highly aluminous refractories became necessary. Highly aluminous brick are superior to clay brick because they suffer less from vitrification and form more refractory mixtures with cement clinker than do clay brick. At the present time the demand for special cements and their more rapid production is resulting in higher operating temperatures which are in some instances beyond the point where even high-alumina brick can perform satisfactorily. Mixtures of cement clinker and unburned magnesite brick are even more refractory than clinker-high alumina brick mixtures, and so allow the operator the opportunity to burn at much higher temperatures than heretofore. This fact, coupled with the unburned magnesite brick's high resistance to vitrification and spalling, makes feasible the use of unburned magnesite brick in the burning zones of rotary Portland cement kilns where operating conditions are unusually severe.

Cement Plant in India Rebuilt; Now Has 750,000 Bbl. Capacity

About a year ago, the Portland-cement plant at Rohtas, India, was completely rebuilt and its capacity doubled. It is now able to produce 750,000 bbl. annually, the entire output being utilized in highway and construction projects in India.

The operating company, known as the Sone Valley Portland Cement Co., Ltd., is a subsidiary of the Associated Portland Cement Manufacturers, Ltd., of London, England. Raw material is obtained from the Kymore Mountains and is carried by aërial ropeway a distance of five miles to the plant located in the valley near the banks of the turbulent Sone River.

Four technical experts, sent from England, have charge of the operation and they are assisted by about 50 especially trained Indians in key positions. When operating at capacity, 2,000 natives are engaged in quarrying and mill production. The cement is marketed under the trade-name of "Japla."



General view of the ready-mixed-concrete plant. Aggregates are supplied by the sand-and-gravel plant in the background.

Adds Second Ready-Mixed-Concrete Plant to Supply Albany, N. Y., Area

Ready Mix & Supply Co. Enters Its Fourth Year in Business of Mixing and Delivering Material

ONE of the first successful ready-mixed-concrete producers in upper New York state was the Ready Mix & Supply Co. at Albany, N. Y. In April, 1929, this company, formerly known as the Albany Trucking Corp., put in operation its original plant, a complete description of which was published in the Nov. 20, 1929, issue of PIT AND QUARRY.

Briefly, the original plant was a concrete-and-steel structure. Sand and gravel from an adjacent plant are fed by a belt-conveyor to the top of the plant. Bulk cement is pumped to storage. Weighing batchers measure the materials to a 3-cu. yd. Rex mixer. This plant has a capacity of about 450 cu. yd. of concrete in 8 hr. The second plant went into operation on July 15, 1931, and the combined capacity of the two operations is now about 120 cu. yd. per hr., using a 2-min. mix.

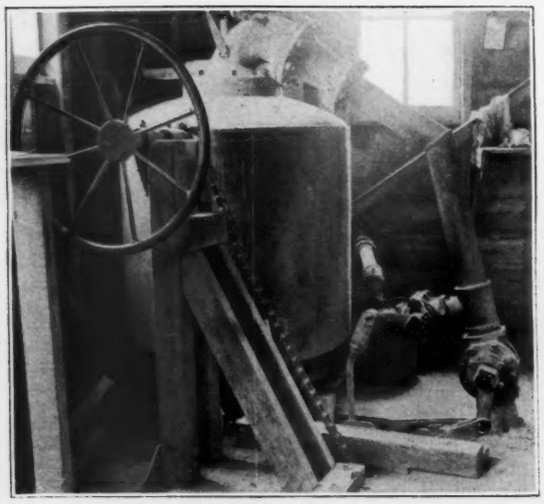
The new plant was bult alongside the old and is of similar construction. The framework and bins are of steel on concrete footing, and the batching floor and the tops of the bins are inclosed with wood. Bulk cement is fed from cars to the 1,100-bbl. three-compartment Butler steel cement-bin at the top of the plant by the same 5-in. Fuller-Kinyon pump serving the other plant.

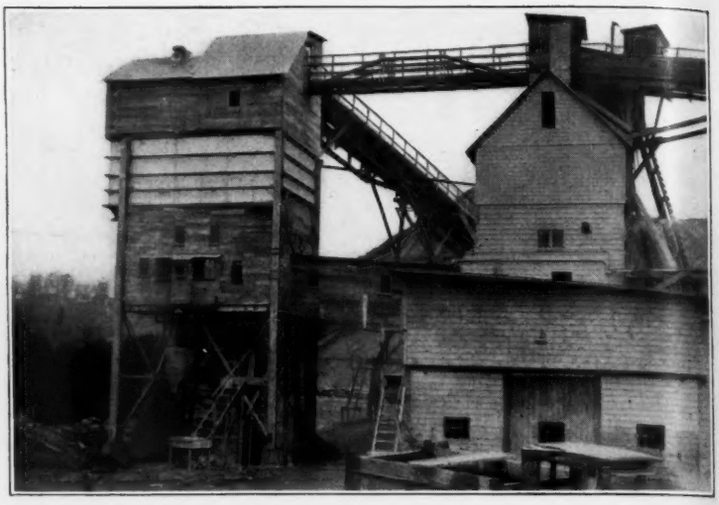
Truckloads of gravel and sand from the plant of the Albany Sand & Gravel Co. discharge to a steel hopper, from which a plate-feeder carries the material to a 30-in. inclined belt-conveyor operating on 285 ft. centers. This discharges by means of a rotary chute to any of four compartments in the 215-ton Butler steel compartment aggregate-bin. The feeder is driven through chain and Dayton Cog-Belt drive by a 5-hp. G. E. motor. The conveyor is silent-chain and gear-driven by a 30-hp. G. E. motor.

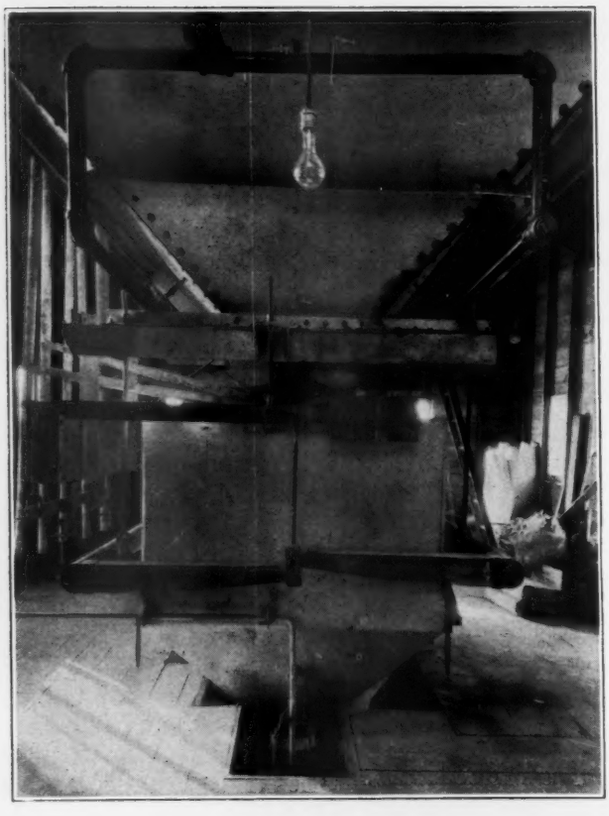
Cement is fed from the bins by a special inclined screw-feeder which is Texrope-driven by a small motor. A lever-operated sliding gate above the feeder provides additional control of the cement feed or can shut it off entirely. The feeder discharges into a 2,500-lb. Butler weighing batcher, which has a single-beam scale and a Starr balance indicator that gives accurate control over the last few pounds weighed. A Fuller Co. rotary valve controls the discharge from the batcher to the mixer. The scale and batcher are electrically interlocked to conform with the specifications of the New York State Highway Department for weighing bulk cement.

Aggregates are fed through six lever-operated gates into the Butler 16,000 lb. aggregate-weighing batcher. This has a 3-beam scale with tell-tale dial. Both batchers discharge through a hopper to a mixer. A light shining into this hopper allows the operator to see what is going on there and in the mixer, which is a standard 3-cu. yd. Rex unit. A telephone connects the batching floor with the plant office for transmitting orders. Water is measured in a 150-gal. Ransome water tank equipped with a Merco-Nordstrom valve.

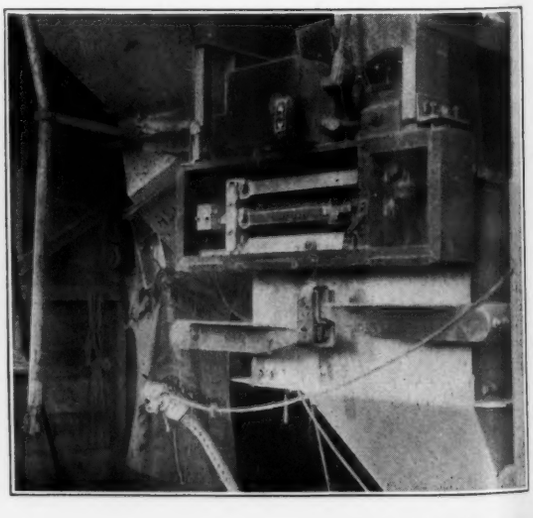
Deliveries are made by a fleet of 19 trucks. Fifteen of these are 3-cu. yd. Clinton agitator bodies mounted on Autocar chassis and two are Bartlett & Snow bodies also mounted on Autocar chassis. For the convenience of the truck drivers in opening and closing the gates through which the agitator bodies are loaded, wooden stairs and platforms have been





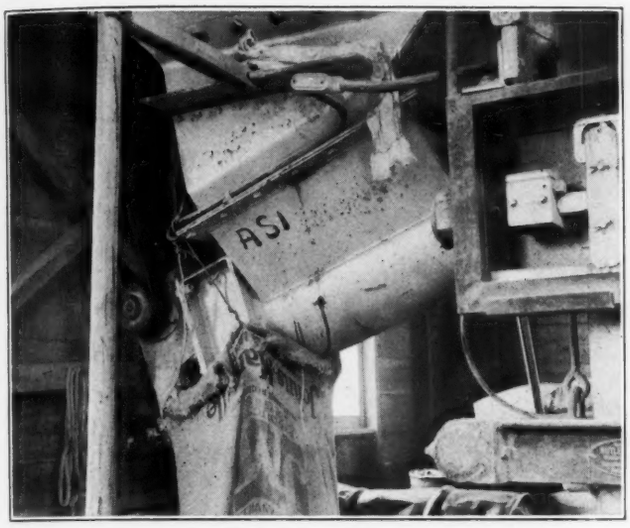


Upper left—Siphon-type water-measuring tank and the wheel controlling discharge from the mixer. *Upper right*—A view showing the new plant at left with old operations at the right. *Left*—Aggregates-weighing batcher, with clam-shell gates above. *Above*—Truck discharging load of aggregates to hopper of conveyor leading to the new plant. *Lower left*—Agitator truck being loaded with concrete. *Lower right*—The cement-weighing batcher and scale with screw-feeder at left.



built on each side of the plant. This arrangement speeds up operations during rush times as one driver can be opening the gate on his truck, while a second driver is loading, and a third is closing his gate.

Each plant is an entirely distinct operating unit with individual material-handling equipment, but



The cement screw-feeder with lever-controlled sliding gate above.

the two plants are operated in coördination as if they were a single unit. A covered passageway connects their batching floors and another passageway connects the tops of the bins, so that easy access from one plant to the other is possible.

The bins and weighing batchers for both plants were furnished by the Butler Bin Co., which also furnished the screw-feeder in the new plant. Goodrich conveyor belting is used on the main aggregate conveyor, and Crouse-Hinds conduit is used throughout both plants.

Automatic Bag Filters Collect Kiln Dust at Ford Cement Plant

(*Continued from page 28*)

rotation, so that the clean gas is exhausted at a temperature of 185 deg. F. without variation in the kiln draft, and there is a regular collection of the recovered dust.

A system of screw-conveyors takes all the dust to one storage-bin, from which a pump delivers it to the kiln feed-chute, where it is discharged to the kiln by gravity, along with the filter-cake. Some dust is carried back out of the kiln before calcining, but after the dust burden in the gas has built up to a certain figure, the concentration remains approximately constant and from then on the only loss in solids is the 1 to 2 per cent. passing up the stack.

TABLE II—ANALYSES OF AVERAGE SAMPLES OF FILTER-CAKE, KILN DUST, AND CLINKER

	Filter-cake	Dust	Clinker
SiO_2	14.40%	14.80%	20.10%
Al_2O_3	4.80	5.90	6.80
Fe_2O_3	2.70	2.30	4.00
MnO	0.53	0.35	0.70
CaO	49.50	49.90	65.20
MgO	2.25	1.81	3.04
SO_3	0.65	7.51	0.20
Total alkali	0.05	2.00	.....
Ignition loss	25.00	15.00	.....

The average dust load at the filters is 9.25 grains per cu. ft., which is recovered at an efficiency of 98 to 99 per cent. There is a by-pass damper from the economizer to the stack and, of course, there is some leakage at this point. The leakage, plus the solids which pass through the filters, is enough to make a slight dust haze at the top of the stack. This is almost negligible, however, and the operators consider the former dust nuisance to have been completely eliminated.

To obtain a measurement of recovered solids the pneumatic pump was shut off, and the dust collected in the filters was tapped out and weighed for a 3-hr. period. The figures correspond to a recovery of 40 tons a day per kiln. Table II gives an analysis of this recovered material, in comparison to filter-cake and clinker analyses, and screen tests on the dust show that 93 per cent. passes through a 325-mesh screen.

There are two draft-gage panel-boards in the filter building, one for each unit, so that the operator can see at a glance draft conditions throughout the whole gas-handling system and can detect any change in the gas flow. Since the preliminary runs were completed, the filter equipment on one kiln has been in continuous operation for a 6-mo. period, and results indicate the absence of any difficulties.

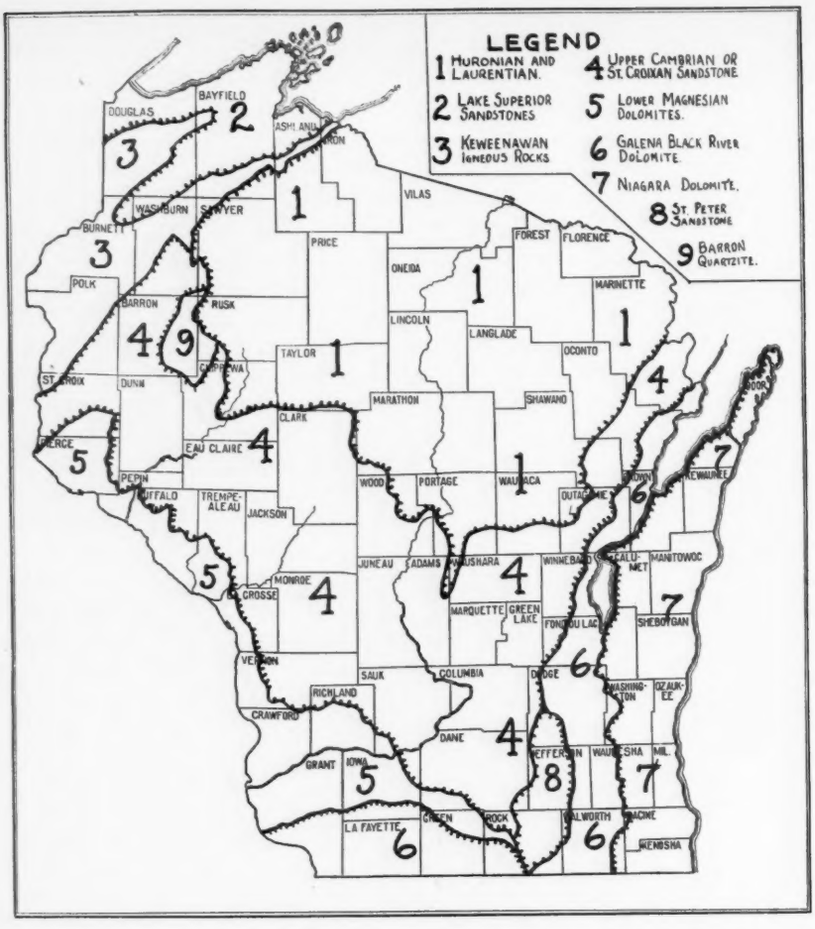
One ton of dust is equivalent practically to an equal weight of filter-cake in respect to clinker yield. Therefore the average recovery of 40 tons per kiln per day replaces 40 tons of raw material, producing, with the kiln output unchanged, 166 bbl. of finished cement. This is equivalent to saying that over 11 per cent. of the clinker is made from stack dust.

Cane Sugar as Strengthening Agent in Lime-Sand Mortars

In a paper presented before the Sugar Division of the American Chemical Society at its meeting in New Orleans, March 29, 1932, Drs. Gerald J. Cox and John Metschl, of Mellon Institute of Industrial Research, Pittsburgh, Pa., discussed their current investigations of the value of cane sugar in strengthening lime-sand mortar. Such an application of sugar is not new, as it is believed that the Romans made use of saccharine materials in mortars that have certainly stood the test of time. Also, in sugar-growing countries it is known that sugar has been employed to increase the strength of mortar.

Drs. Cox and Metschl have found that there is very good reason for the empirical practice of "sweetening" mortar. From their experiments they have ascertained that mortar which contains sugar equal to 6 per cent. of the quick-lime content has a tensile strength 60 per cent. greater than that of mortar containing no sugar. Further tests are planned of compression strength, setting time and durability as influenced by cane sugar.

The process of mixing the sugar with the mortar is quite simple. The sugar is dissolved in part of the gaging water and mixed in with the sand and lime. The sugar must not be mixed with the lime before slaking.



Geological map roughly outlining surface distribution of formations.

The Nonmetallic-Mineral Resources of Wisconsin

By E. F. BEAN
State Geologist

THE principal nonmetallic-mineral resources of Wisconsin are stone, sand and gravel, and clay. The accompanying geological map indicates the surface distribution of the geological formations. In the northern part of the state is a shield-shaped area underlain by pre-Cambrian crystalline rocks—granite, gneiss and trap. Surrounding this area and dipping away from it toward the nearest state boundary are sedimentary rocks—sandstones, limestones and shales—which are arranged like the shingles on a roof, except that the butt ends of these formations face up the roof.

Bordering the pre-Cambrian area a crescentic belt of Cambrian sandstone extends from Marinette County southwest to Portage, thence northwest to Washburn County. Overlying the Cambrian sandstone is the Lower Magnesian dolomite which outcrops in a belt east, south, and west of the Cambrian sandstone area. The St. Peter sandstone is the next higher formation. Over this is the Galena-Black River dolomite. The Richmond shale is the next in the series. The next higher formation is the Niagara dolomite. The western edge of this is a bluff extending from northern Waukesha County to northern Door County. Near Milwaukee is the Devonian Milwaukee formation. All the state, with the exception of the southwestern part, was covered by the continental ice sheet, which left extensive deposits of sand and gravel and clay and concealed much of the rock surface.

The types of stone quarried in Wisconsin are dolomite, granite, quartzite, trap, and sandstone. In 1929 the value of stone produced was over $6,000,000.

Dolomite.—The most important stone is dolomite, which is quarried in the eastern, southern, and western parts of the state. All the dolomite formations are utilized, but the Niagara formation in the eastern part is quarried most extensively. This is due in part to the fact that this is the most densely settled portion of the state. The color varies from buff to blue. There is great variation in the thickness of the beds and in the texture. The principal uses are for crushed stone, building stone, and lime. The crushed stone is employed for road surfacing, concrete aggregate, and ballast. The suitability of this dolomite as concrete aggregate may be appreciated from consideration of the following tests made by the Wisconsin Highway Commission laboratory. The strength of concrete at 28 days made from eastern Wisconsin dolomite is as follows:

Transverse (*lb. per sq. in.*)		Compressive (*lb. per sq. in.*)	
Range	Average	Range	Average
750 to 1,000	890	3,000 to 5,000	3,860

The growing appreciation for the beauty and utility of Wisconsin dolomite is shown in its increased use in building construction. This use will probably increase rapidly. Wisconsin lime is dolomitic lime of excellent quality.

Complete statistics of production are not available. The figures tabulated below would be greatly increased if all the local production of stone for building, crushed-stone highway surfacing, and agricultural limestone were available.

Value of Dolomite Production, 1929

Crushed stone	$3,051,000
Building stone	273,000
Other uses	558,000
	$3,882,000
Lime	1,094,000
Total reported value	$4,976,000

Door, Waukesha, Racine, Milwaukee, Grant, Winnebago, and Vernon Counties are the leading producers of dolomite; Waukesha, Milwaukee, and Racine Counties are the leading producers of building stone; while Manitowoc, Dodge, and Calumet Counties are the leading producers of lime.

Granite.—Granite quarries are located within the northern pre-Cambrian area and in outlying granite outcrops in the sandstone belt. The granites of the state are widely known for their beauty and hardness. There are all colors from brilliant red to dark gray and black. The textures vary from exceedingly fine-grained to very coarse-grained. The state is employing dark-gray granite from Marinette County in the construction of the new office building at Madison. Granites from Wausau, Montello, Waupaca, Lohrville, Berlin, and Red Granite have been widely used both for monumental and building purposes. The beautiful "black granite" quarried at Mellen meets the demands of architects for a black stone to contrast with lighter stone. Another black-granite quarry has recently been opened near Merrill. Waushara, Marathon, Marquette, Ashland and Marinette Counties are the leading producers.

Value of Granite Production, 1929

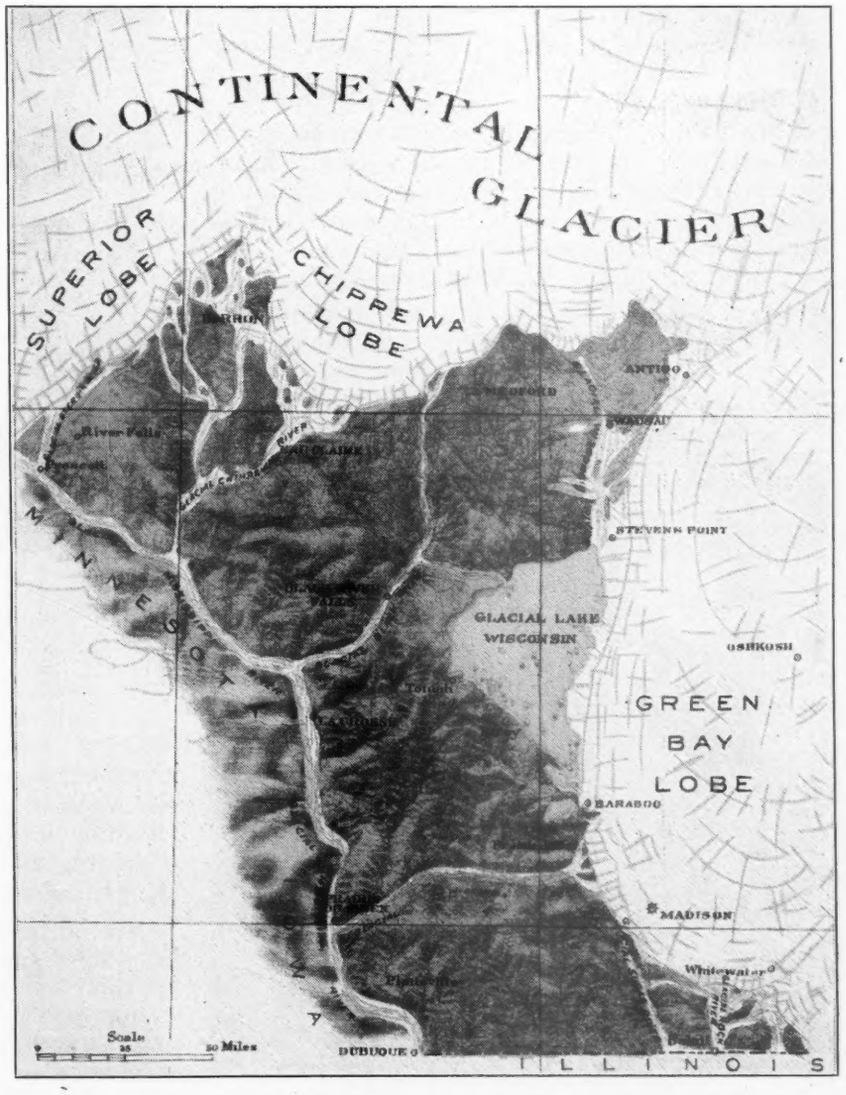
Monumental stone	$1,134,120
Building stone	187,207
Paving blocks	250,683
Riprap	112,268
Crushed stone	210,558
Other uses	23,571
Total	$1,918,407

Quartzite.—Baraboo quartzite is quarried at Devil's Lake, North Freedom and Ableman for use in the manufacture of refractory brick for furnace or converter linings. Similar quartzite outcrops near Waterloo. The Wausau quartzite is employed as an abrasive.

Trap.—A large trap-rock quarry at Dresser Junction in Polk County produces crushed stone of excellent quality. There are numerous outcrops of trap in the northern part of the state.

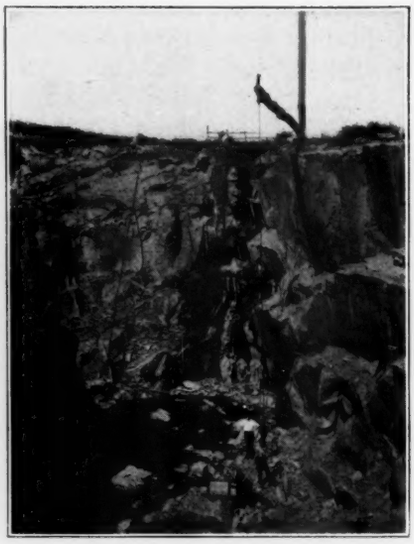
Sandstone.—The brown stone of northern Wisconsin was at one time a very popular building stone. Private homes in the most exclusive districts, as well as many public buildings, were built of it. The fashion changed and demand turned to lighter-colored stone. The sandstones of the southern part of the state range in color from white through buff and brown to brilliant red. At present the buff-colored stone stands highest in public favor. Sandstone from Dunn County was chosen to complete the cathedral of St. John in New York City. This stone was favored because of its soft cream color, in addition to the fact that it is adapted to the finest kind of carved work. The Madison sandstone is extensively used in buildings in Madison. This stone has been used in the construction of university buildings. Sandstone is quarried in large quantities at Ableman. St. Peter sandstone is quarried at Browntown as a source of silica sand. Cambrian sandstone is quarried for molding sand near Portage and near Bay City.

Sand and Gravel.—Since all but the southwestern one-fourth of the state was glaciated, there is throughout the glaciated portion of the state an abundant supply of sand and gravel. Commercial plants are most numerous in the southeastern part of the state. This development is related to the fact that this area is the most densely populated part of the state and is close to the Chicago district. Nearly all the commercial plants are exploiting outwash deposits. These were built by the sand-and-gravel-laden streams which flowed away from the melting ice of the continental glaciers. In many cases these outwash deposits were built in old valleys, thus forming valley trains, some of which are



The driftless area of Wisconsin at the Wisconsin stage of glaciation.

Beach gravel pit in Outagamie County.



Marathon Granite Co. quarry near Wausau.

Esker gravel ridge in Rusk County.

very thick. The known depth of sand and gravel in the pre-glacial Rock River valley near Janesville is 330 ft. In the Wisconsin River valley, near Wausau, there is a depth of at least 100 ft. In the Chippewa River valley at Eau Claire the gravel fill has a thickness of 260 feet. In the Mississippi River valley at La Crosse the thickness of the outwash sand is 170 ft. At Prairie du Chien the deposit is 147 ft. in thickness.

In 1929 10,757,000 tons of sand and gravel, valued at $4,574,000, was produced, thus giving the state rank of tenth in value and eighth in quantity in the United States. If complete figures were available, not only for all commercial-plant production but for local production, the total figure would be much larger. Nearly every county in the glaciated area produces large tonnages which do not appear in the tabulated statistics. The counties leading in the reported production are Waukesha, Dane, Chippewa, Rock, and Columbia.

The principal uses are shown in the production-statistics table below. There are enormous undeveloped deposits of sand and gravel, especially in the southeastern part of the state, hence the production of concrete aggregate should continue to be the most important product. Shale and slate are practically non-existant in these gravels. In a few plants clay balls or sandstone are removed from the belt by hand. As concrete aggregate the sand and gravel of Wisconsin is of very high quality.

Sand-and-gravel plant of Consumers Co. at Beloit.

Mortar Strength of Sand, 28 Days
(per cent. of standard)

	Range	Average
Igneous	104-134	122.2
Dolomitic	125-160	140.5

Concrete Strength of Material, 28 Days

	Transverse (*lb. per sq. in.*)		Compressive (*lb. per sq. in.*)	
	Range	Aver.	Range	Aver.
Igneous gravel	682 to 805	745	3,400 to 4,450	3,830
Dolomitic gravel	748 to 918	837	3,450 to 4,650	4,000

The glacial geology of this area has been mapped in detail and an excellent map for the guidance of any organization seeking new deposits has been prepared.[1] Attention should be concentrated upon outwash deposits.

The molding-sand production will probably increase in value, since there are numerous undeveloped deposits.[2]

1929 Statistics

Paving sand and gravel	$2,921,444
Building sand and gravel	950,849
Railroad ballast	501,140
Molding sand	82,508
Grinding and polishing sand	73,132
Engine sand	14,306

Owing to differences in geology, the character of the sand and gravel varies greatly. In the dolomite areas from 65 to 90 per cent of the gravel is dolomite. In the pre-Cambrian area the sand and gravel is derived from granitic rocks and is there-

[1] U. S. Geological Survey Professional Paper 106, Quaternary Geology of Southeastern Wisconsin.
[2] *Molding Sands of Wisconsin*, Wis. Geol. Survey Bull. 69, 1928.

fore very low in soluble constituents. For some special uses such sand and gravel is highly desirable. Golf courses in many cases specify acid sand. Blast sand should be highly resistant.

Cement.—There is but one cement mill in the state, that of the Manitowoc Portland Cement Co. at Manitowoc, which has an annual capacity of 1,200,000 bbl. It employs a local glacial clay and limestone shipped from Michigan. Investigation has not disclosed any limestone deposits in the state suitable for the manufacture of Portland cement. The formations in the state are dolomites which carry a prohibitive percentage of magnesia.

Clay Products.—The clays are of several types: residual, transported, marine, glacial lake, glacial till.

Residual clays resulting from the weathering of igneous and metamorphic rocks are confined to the pre-Cambrian area. The Richmond shale (see the geological map) outcrops in a narrow north-and-south-trending belt in eastern Wisconsin. In the southwestern part of the state this shale caps some of the higher uplands and forms the lower slopes of the highest mounds. Plants employing this shale are operated near Stockbridge and near Oakfield. Glacial-lake clays were deposited in the quiet waters of temporary lakes formed by the blocking of drainage during the glacial period. Such clays underlie large areas along Lakes Michigan and Superior,

Distant view of quartzite workings near Devil's Lake.

around the Green Bay-Lake Winnebago lowland, near Menomonie in Dunn County, in a great area over 1,800 sq. mi. in extent in central Wisconsin, and in a large area near Grantsburg in the northwestern part of the state. The texture and composition of these clays are likely to be uniform over any area considered as a source of clay. Glacial till is a clay mixture deposited by melting ice. Gravel and boulders are usually mingled with clay.

The clay products are common and face brick, hollow tile, and drain tile. The manufacture of clay products is capable of expansion since the production within the state is not sufficient to meet the requirements.

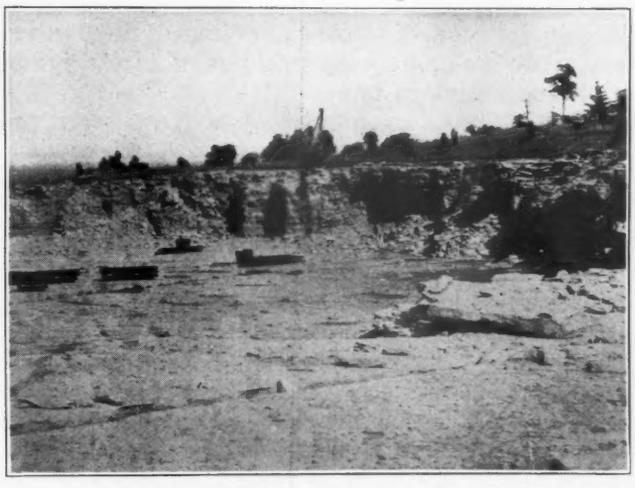
Talc and Soapstone.—Near Milladore in Wood County there is a small talc and soapstone mine. This is a resource that is capable of considerable expansion. The Wisconsin deposit is favorably situated, since all other production is in the East or West.

Marl.—Throughout much of the glaciated portion of the state there is marl in the lakes, and in marshes and lowlying areas which were formerly covered by water. Many of these deposits have

Pond dredging in a gravel pit near Janesville.

been developed as a local source of agricultural lime. At one time there was considerable interest in marl as a source of calcium carbonate for the manufacture of Portland cement. Modern cement plants do not use marl because of its high water content, the scarcity of very large pure deposits, and the difficulty of operating marl deposits during the winter.

Peat.—Peat is found scattered over the state in many marshy areas and lowlands. It occurs in beds varying from 1 or 2 ft. to 20 ft. or more in depth and from 10 to 30,000 or more acres in area. Attempts have been made to utilize the peat in a few deposits



Limestone quarry at Greenleaf.

for fuel and in the manufacture of paper-board, but rials become scarce and expensive. It seems certain the outcome proved unsatisfactory. Little use will be found for peat until such a time as other matethat the development of the peat lands will be long deferred.

Shale and Its Metamorphic Equivalents in Aggregates for Road Work*

By E. F. BEAN

NEARLY all specifications for concrete aggregate directly or indirectly place shale in the list of deleterious substances. In Minnesota the tolerance is not more than 2½ per cent. by weight in sand and in coarse aggregate not more than 0.4 per cent. by weight of the portion between 2 in. and ¾ in., and not more than 0.7 per cent. by weight of the entire sample. These limits were developed by observation of the effect of shale in concrete. Michigan permits up to 3 per cent. of shale in concrete coarse aggregate.

It has appeared to the Committee on Correlation of Research in Mineral Aggregate that the geological aspect of shale should be considered. This paper, therefore, will discuss the origin and characteristics of shale and its metamorphic equivalents from the standpoint of highway aggregates.

Clay.—Clay is the fine-grained product of rock weathering. Twenhofel [1] defines clay on the basis of grain size as having particles less than 1/256 mm. in diameter and silt as consisting of particles between 1/256 mm. and 1/16 mm. in diameter. The primary source of clays is weathered igneous rocks. Clay is produced also by the decomposition of sedimentary rocks, especially shale and limestone. "The minerals of the clays consist of hydrous aluminum silicates of the kaolin group (containing more or less of adsorbed alkalines and alkaline earths); minerals of the chlorite group; hydrous iron oxide; secondary quartz and opal; carbonates of calcium, magnesium, and possibly iron; small amounts of sulphate (probably largely gypsum); fine-grained fragmental quartz; feldspar; micas; ferromagnesian minerals; and very small amounts of original unaltered accessory minerals." [2]

Shale.—In the sense generally employed shale is a consolidated clay, forming a close-grained rock which may be laminated with excellent parting parallel to the bedding or it may be nearly massive. Consolidation is accompanied by cementation, which may be due to the crystallization of colloidal envelopes surrounding the minerals. The change is a progressive one. In the early stages, before much crystallization and dehydration have taken place, the process of hardening may be reversed by soaking in water. As a rule shale slakes more readily after it has been air-dried. The cretaceous shale at Red Wing, Minn., slakes readily in 3 min.[3] Some exposures of the Coldwater (Lower Mississippian) shale of Michigan slake more slowly.

The term shale is loosely employed as a structural term to describe not only shale but also other thin bedded rocks, particularly sandstone and limestone. Since the original sediment was not in all cases pure clay, there are all gradations, with increasing sand content, between shale and argillaceous sandstone. With an increasing proportion of calcareous material shale grades into argillaceous limestone. Shales are usually soft, cut readily and are brittle. They vary greatly in color but shades of gray are the most common. Geologically shales are important since it has been estimated that 80 per cent. of the sedimentary rocks are shale. Outcrops, however, are not common owing to rapid weathering.

The average clay [4] has a mineral specific gravity of 2.68 and the average shale a mineral specific gravity of 2.71. Porosity of the clay is largely eliminated by compression. The average porosity of clays is 27 per cent. and that of shales is but 13 per cent. The average mineral composition of shales is as follows: [5]

Quartz	31.91	Gypsum	1.17
Kaolin	10.00	Orthoclase	12.05
White mica ...	18.40	Albite	5.55
Chlorite	6.40	Rutile	.66
Limonite	4.75	Apatite	.40
Dolomite	7.90	Carbon	.81

"There are, of course, wide variations from this average. The shales have a much smaller proportion of amorphous constituents than clays. The colloidal substances have largely disappeared. Kaolin and the ferric hydrates have decreased to a marked extent. The fine-grained matrix or paste of the shales consists of finely granular quartz or chert, containing considerable quantities of white mica and locally rutile. Much of the iron is reduced to the ferrous condition in combination with silicates (principally chlorite) and as carbonate. It may be combined with sulphur, which is often present under these conditions, to form pyrite. The presence of carbonaceous matter favors this reduction, as shown by the common association of iron carbonate and sulphides with granitic shales. The result is often a change of color of the rock from yellowish or reddish to greenish gray or black." [6]

Slate.—A shale becomes a slate through one or more of the following: (1) long continued pressure; (2) contact metamorphism or dynamic action; or (3) through the effects of high temperature and pressure. The mineral grains are so small as not to be distinguishable to the eye. By the development of a parallel arrangement of the mineral constituents a fine cleavage is imparted, generally at an angle to the bedding. The change from shale to

* Presented at the 11th annual meeting of the Highway Research Board.

[1] Twenhofel (W. H.), *Treatise on Sedimentation*, p. 186.

[2] Leith and Mead, *Metamorphic Geology*, p. 76.

[3] Grout (Frank F.), *Clays and Shale of Minnesota*, U. S. Geol. Sur. Bul. 678, p. 189.

[4] Leith and Mead, *Metamorphic Geology*, p. 108.

[5] *Ibid.*, p. 76.

[6] Leith and Mead, *Metamorphic Geology*, p. 104.

ANALYSES OF CLAYS, SHALES, SLATES, AND SCHISTS

	A	B	C	D
SiO_2	54.28	58.38	61.90	65.74
Al_2O_3	14.51	15.47	16.54	17.35
Fe_2O_3	6.25	4.03	2.73	1.90
FeO	.77	2.46	3.63	3.35
MgO	2.99	2.45	2.99	1.90
CaO	5.04	3.12	1.07	1.25
Na_2O	1.21	1.31	2.57	1.78
K_2O	2.12	3.25	3.15	3.28
H_2O	8.41	5.02	3.84	2.01
TiO_2	.42	.65	.82	.55
CO_2	3.53	2.64	.59	None
P_2O_5	.09	.17	.04	.12
SO_3	.08	.65	.03	.03
Cl	.02	.....	Trace	Trace
F	.....	.....	Trace	.07
MnO	.08	Trace	Trace	.03
SrO	.....	None	Trace	Trace
BaO	.....	.05	.01	.05
Li_2O	.....	Trace	Trace	Trace
FeS	.....	.....	.11	.....
C	.24	.81	.22	.58
	100.04	100.46	100.24	99.99

A. Average of 12 analyses of clays and soils.
B. Average of composite analysis of 78 shales.
C. Average of 22 analyses of slates.
D. Average of 5 analyses of schists.

slate is marked by a development of the platy minerals, principally muscovite and to a less extent chlorite, which are responsible for the slaty cleavage. The process of alteration may be only partial, resulting in a clay slate, having as its chief constituents clay, mica, and chlorite. If the process is carried still further, a mica slate results. In this little or no clay remains, the chief constituents being mica, quartz, and chlorite. The most abundant mineral is white mica (sericite). Argillaceous rocks may be transformed into massive rocks, devoid of cleavage, which are chemically and mineralogically slates.

Phyllite and Schist.—The word phyllite means leaf stone. Phyllites are metamorphosed slates, characterized by excellent cleavage, by means of which they split into thin sheets. The surface is sometimes flat, sometimes wavy and irregular. Mica may constitute more than 50 per cent. of the weight of the rock. Mica schists may represent a continuation of the recrystallization process which developed the slate, resulting in a foliated rock with a coarser grain. The individual folia are mineralogically alike and the principal minerals are so large as to be visible to the naked eye.

Summary of Relationship.—Shales, slates, phyllites, and mica schists, therefore, form a continuous series of rocks which can be derived from clay by progressive metamorphism (dehydration and crystallization). The general order of change from clay to schist is shown by the accompanying analyses.[7]

There is a progressive loss of water and carbon dioxide in the change from clay to schist. Carbon dioxide has been replaced by silica, which has proportionally increased as a cementing material. Ferric iron is partly reduced to the ferrous state and there is an apparent gain in alumina.

Weathering.—Since all the rocks in this series have been derived from the weathering of preexisting rock, they are chemically stable, and break down under weathering largely through mechanical processes, yielding clays. Their susceptibility to destruction by weathering is determined by the degree of metamorphism; the shales, having been least metamorphosed, weather most rapidly. Since shale is exceedingly fine-grained, the pore spaces are subcapillary in size, water is confined, and the destructive effect of freezing is much greater than in a porous sandstone. As mica slates are more resistant to absorption, and are, therefore, more resistant to weathering than clay slates, they have long been considered one of the most durable of building materials. Bowles[8] reports a slate roof in good condition after 1,200 yr. of service.

Shales in Gravel.—Since shale weathers rapidly, outcrops are uncommon in spite of the fact that it is a very important sedimentary rock. Weathered shale is an important constituent of glacial till in shale areas. In areas underlain by shale it is a relatively common constituent of gravel. The better gravels have been subjected to such vigorous abrasion that the soft unstable constituents have disappeared and only the hard and durable materials remain. Gravels, derived in part at least from areas of shale outcrop, contain a proportion of shale fragments determined by the distance transported and the amount of abrasion experienced *en route*. The shale in glacial gravel has been subjected to grinding within the ice, and to abrasion before deposition by a glacial stream. A wave-cut exposure of shale furnishes pebbles to the beach. If wave action is vigorous, these pebbles are worn out during relatively short transportation along shore. The percentage of shale pebbles in stream gravels decreases rapidly upon transportation away from the ledge.

A study of the aggregate in the weathered zone of gravel exposures gives many data regarding shale. Here all the material has been subjected to a service test. An original shale pebble may be represented by small chips or by a mass of clay. In recently worked portions of the deposit the shale pebbles may appear quite hard and sound, since they have not been exposed to alternate wetting and drying and to freezing and thawing.

While there are all gradations between shale and mica schist, the most common problem in the field is to differentiate shale from slate. A simple test is to grind the specimen to powder and mix it with water. Shale subjected to this treatment becomes a soft plastic mass, while slate does not. In the outcrop shales weather to clay, while slates tend to break into angular fragments of varying size.

With shale present in gravel there is some possibility of removing it in the plant, but the following data regarding specific gravity of various types of rock indicate that there will be considerable difficulty in effecting complete separation by any method that depends upon relative specific gravities.

Specific Gravity of Wisconsin Stone[9]

	Average	Maximum	Minimum
Granite	2.655	2.713	2.629
Dolomite	2.808	2.836	2.740
Sandstone	2.631	2.660	2.524

[7] Clarke (F. W.), *Data on Geochemistry*, U. S. Geol. Sur. Bul. 770, p. 631.

[8] Bowles (Oliver), *The Technology of Slate*, U. S. Bur. of Mines Bul. 218, p. 7.

[9] Buckley (E. H.), *Building and Ornamental Stones*, Wis. Geol. Survey, Vol. 4, p. 371.

Average Specific Gravity of Rock Samples [10]

Basalt	2.86	Sandstone	2.56
Granite	2.66	Mica Schist	2.77
Limestone	2.65	Slate	2.76
Dolomite	2.72		

The specific gravity of 9 samples of shale[11] is as follows: Maximum 2.70, minimum 2.50, average 2.56. The specific gravity of 18 Iowa shales [12] is as follows: Maximum 2.64, minimum 2.25, average 2.45.

A system of grinding which would destroy the shale and the friable particles might be effective, provided the cost were not excessive. This would reproduce in the plant nature's method of destroying such material.

Shales in Quarries. — If a limestone quarry is under consideration, the weathered ledge should be carefully examined for evidence of shale. Thin beds of limestone or dolomite are usually separated by thin laminæ of shale. Even massive beds decrepitate upon weathering, because of paper-thin shale partings. Loughlin [13] ascribes the failure of a western Pennsylvania limestone to clay and organic matter in irregular spots. The clay mineral was beidellite. Chemical analyses of limestone are a valuable indicator of the clay content. By a studied selection it is possible to eliminate in quarrying the undesirable stone, thus bringing the crushed product up to requirements. The service history of quarried stone is a valuable source of information. Many quarries have been in use for many years and buildings of long standing indicate the quality of the stone. It must be remembered that care has usually been exercised in selection so that only the more durable beds were utilized.

Slates and Schists as Aggregates.—Slates and schists are composed of minerals very resistant to atmospheric weathering. These rocks are, therefore, sound, but are usually undesirable as road materials for structural reasons. Tests of Pennsylvania slate [14] showed the following results:

Porosity *(per cent.)*	0.196
Tensile strength *(lb. per sq.in.)*	3.625
Compression strength *(lb. per sq.in.)*	10.250
Abrasion *(per cent. of wear)*	5.12
Abrasion (French coëfficient)	7.81
Toughness	11.5
Hardness coëfficient	11.0

The tendency of these rocks to produce flat and elongated fragments is considered objectionable. Thin-bedded limestones and sandstones are subject to the same objection.

[10] U. S. Dep. of Agriculture Bul. 348, Table 1.

[11] Reis and Watson, Engineering Geology, p. 601.

[12] Iowa Geol. Survey, Vol. 14, p. 116.

[13] Loughlin, G. E., Qualifications of different kinds of natural stone for concrete aggregate. Am. Con. Inst., Proceedings, Vol. 23, pp. 319-351.

[14] Oliver Bowles, Technology of Slate, Bureau of Mines, Bulletin 218, p. 7.

New Cement Plant Under Construction in U. S. S. R.

Activity in construction continues unabated in the U. S. S. R. The above picture, supplied through the courtesy of "Economic Review of the Soviet Union" shows a cement plant under construction at Podgornoye in the Central Black Soil Region.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

Strauss Photo

K. W. LICK

General Superintendent
General Material Co.
St. Louis, Mo.

Coming Events

April 19-21, 1932. Columbus, O. Fifth All-Ohio Safety Congress. T. P. Kearns, Ohio Industrial Commission, Columbus.

May 5, 1932. Newark, N. J. Eighth Annual Eastern Safety Conference. F. M. Rosseland, secretary, Newark Safety Council.

May 12, 1932. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

May 19, 1932. Erie, Pa. Seventh Annual Northwestern Pennsylvania Safety Conference. S. M. Lippincott, secretary, Erie Safety Council.

May 24-25, 1932, Cleveland, O. Annual Convention, National Lime Assn. Norman G. Hough, president and general manager, 927 Fifteenth St. N. W., Washington, D. C.

June 20-24, 1932. Atlantic City, N. J. Annual meeting of American Society for Testing Materials. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

October 3-7, 1932. Washington, D. C. Twenty-first Annual Safety Congress, National Safety Council. W. H. Cameron, secretary, 20 N. Wacker Drive, Chicago, Ill.

Pumpings from the Old Pit

Excerpts from the old files of PIT AND QUARRY *reveal many interesting sidelights on the activities of the pits, quarries and plants of former days. These are printed in this column each issue.*

Fifteen Years Ago

WHAT was said to be the first sand-and-gravel plant on the Pacific Coast to be equipped with a slackline cableway system for excavating pit materials, was being operated by the California Building Materials Co., a short distance from the city of Oakland. Material was taken from a bed of a creek which had been a bonanza in the gold-rush days of '49. The plant was also said to be quite modern in that it was electrically operated, power being supplied from the lines of the Pacfic Gas & Electric Company.

* * *

Horton & Horton, sand and gravel producers at Houston, Tex., were planning to move their operations on the Colorado River further downstream. The company was shipping about eleven carloads of material daily.

* * *

The Builders' Sand & Gravel Co. was incorporated at Chicago with a capital of $50,000. The incorporators were: Adrian L. Hoover, James T. Haviland and Wm. F. Waugh.

Ten Years Ago

MEMBERS of the Illinois Concrete Aggregates Assn. held a meeting at the St. Nicholas Hotel, Springfield, Ill. Burton H. Atwood, presided. One of the highlights of the meeting was a trip to the Bates Test Road, located a short distance from Springfield, where a wide variety of road building materials were being tested under actual traffic conditions.

* * *

Sale of the Great Lakes Stone & Lime Co. of Rockport, Mich., to the Kelley Island Lime & Transport Co. of Cleveland, O., was announced by John A. Kling, president of the concern. The purchase price was in the neighborhood of $1,250,000, it was reported.

* * *

Cement mills in the Birmingham, Ala., area had increased production to a capacity basis, due to the heavy demand for that commodity. Plants in that area were called upon to produce 2,000,000 bbl. of cement during the year for road building alone.

* * *

The Wolf River Sand Co. of Memphis, Tenn., purchased 150 acres of deposits adjoining its properties at North Memphis and planned the installation of considerable new equipment to handle production from the newly acquired tract.

* * *

R. F. Whale of Waupaca, Wis., and J. M. Ballait of Appleton, Wis., announced the formation of the Appleton Sand & Gravel Co. The new concern planned to acquire several operating plants in the vicinity of Appleton and to establish new properties where economic conditions seemed to warrant their construction.

Five Years Ago

NEW incorporations included the following companies: Bloomer Limestone Co., Inc., Dover, Dela.; Edward Lutz Sand & Gravel Co., Milwaukee, Wis.; Mississippi Concrete & Material Co., Jackson, Miss.; Christner Gravel & Construction Co., Elkhart, Ind.; Bergen Sand & Gravel Co., E. Paterson, N. J.; Hawkeye Material Co., Iowa City, Ia.

New Yorkers Seek More Funds for Highway Work

A campaign planned to reach every nook and corner of New York is now under way to demand a special session of the state legislature that will make additional funds available for highway construction as a means of practical unemployment relief. It is being directed by the New York State Construction Council, organized last month by representatives identified with the construction industry. Business organizations back of the drive have turned loose an army of 3,000 workers who are devoting much of their time to explaining the needs and merits of a special session.

"Too many millions are being spent for absurd and inconsequential relief work," said S. A. Scullen, chairman of the Council.

"Ninety-one cents out of every dollar spent for modern highway construction goes to wage earners—those who work on the job and those who work in the industries that supply the materials. This is not a haphazard figure, but one that was determined after long and careful research by Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads.

"In 1931 the motorists paid $71,000,000 in taxes and got approximately 1,000 miles of state highways. In 1932 they will be assessed an additional $21,000,000, or a total of $92,000,000, and get only 355 miles of state highways. There is no equity in this, either for the motorists or the unemployed."

Col. H. C. Boyden, well-known throughout the cement industry for his technical lectures on cement and concrete, while a member of the staff of the Portland Cement Assn., resigned to join the promotional staff of the Celite Products Co., makers of a concrete admixture.

* * *

Dewey A. Schlemer was appointed sales manager of the Yosemite Portland Cement Company with office at Fresno, Cal.

* * *

W. J. Van Valkenburgh, a former sales director for the Blue Diamond Co. and Reliance Rock Co. of Los Angeles, was appointed sales manager for the Union Rock Co., also of Los Angeles, succeeding Walter Moore who had taken a position as sales manager with the Consumers Rock & Gravel Company.

* * *

H. R. Albion was appointed district engineer in charge of the Jacksonville, Fla., office of the Portland Cement Assn. Mr. Albion had been field representative for the association in Florida for several years prior to his appointment.

Personal Mention

A. **J. Cayia,** superintendent of the Inland Lime & Stone Co., was elected a director of the company at its annual meeting held at Manistique, Mich., last month. Mr. Cayia succeeds I. N. **Bushong** of Gladstone, Mich.

Fay R. **Burnes,** for many years employed in the offices of the Newaygo Portland Cement Co., at Newaygo, Mich., has taken a position in the plant office of the Medusa Portland Cement Co. near Toledo, O.

C. J. **Delbridge,** of Sioux Falls, S. D., has been named by the governor to succeed **Nick Caspers** as a member of the South Dakota Cement Plant Commission.

L. Max Lee of 114 West Seventeenth St., Los Angeles, has been appointed sales representative for southern California by the Dings Magnetic Separator Co., of Milwaukee, Wis.

Samuel White and **R. B. McIlroy** of Anaheim, Cal., are preparing to open a slate quarry near Keeler, Cal. Flagstone and roofing granules are to be produced, it is said.

Otto H. Falk, president of Allis-Chalmers Manufacturing Co., has been elected a member of the board of directors of the Harnischfeger Corp. of Milwaukee, succeeding J. O. Eaton.

William S. Wilbraham, who has been in charge of the estimating and order department at Lukenweld, Inc., Coatesville, Pa., since this organization was established in 1929 to manufacture welded parts for machinery and equipment, has been appointed assistant manager of sales, and will work directly with **Henry H. Peck,** manager of sales for Lukenweld, Inc.

Guy H. Billings has been named assistant general manager of the Four Wheel Drive Auto Co. of Clintonville, Wis., manufacturer of FWD trucks. Mr. Billings, who has been with the company for nineteen years, has served the past seventeen years as purchasing agent. He will still retain the title of purchasing agent in his new position.

Guy H. Billings.

Mr. Billings joined the Accounting Department of the FWD organization in 1913. At that time the FWD organization was only three years old and comparatively small. Through his years as head of the purchasing department, he has purchased millions of dollars' worth of materials and has so expertly handled his work that years ago he earned the title of "Czar of the Purchasing Fraternity."

Joseph Barnett, an employee of the United States Silica Co. at Ottawa, Ill., suffered a fractured leg recently when a bundle of iron pipe he was carrying dropped upon the member. He has been confined to a hospital.

C. W. Ross, of the Philadelphia office of the C. O. Bartlett & Snow Co., Cleveland, has been transferred to the New York office, where he will be associated with **W. H. Norrington,** the New York manager, in serving the eastern territory.

A. W. Martin is reported to have taken over the management of the Glenwood Sand & Gravel Co., with plant near Eugene, Ore.

William Morris Davis, emeritus professor of geology at Harvard University, has been awarded the Penrose Medal by the Geological Society of America, established in 1927 by the late R. A. F. Penrose, Jr.

E. C. Andrews, chief government geologist of the New South Wales Mines Department, is retiring, and will prepare a treatise on the geology of Australia. Three years ago Mr. Andrews delivered the Silliman lectures at Yale University.

Frederick W. Kelley, Jr., son of the president of the North American Cement Corp., has returned to his home in Albany, N. Y., from a trip around the world. Mr. Kelley is a recent graduate of Cornell University and was an athlete of note.

C. L. Briggs, of Lake Charles, La., and **W. B. Landes,** of Beaumont, Tex., are reported to construct a concrete-pipe plant at an old sugar refinery site in Lafayette, La., to cost about $15,000.

George M. Norman has been appointed manager of the development department of the Hercules Powder Co. Mr. Norman, who is a director of the company, has been head of the technical department, the divisions of which will now function separately. **H. E. Kaiser** will supervise research and experiment, and **G. E. Ramer** will supervise engineering activities. **J. M. McVey** is appointed assistant manager of the development department. **Charles A. Higgins,** vice-president, who formerly directed development work, is assigned increased executive responsibilities, according to the announcement.

Mrs. Caroline Eden, reported to be one of the largest stockholders of Superior Portland Cement, Inc., and widow of the late John C. Eden, former president of the company, was married recently to John Pike of Los Angeles. They will reside in Los Angeles following a honeymoon to Vancouver Island and Hawaii.

Obituary

Milton Newmann, aged 27, a member of the gravel-producing firm of W. E. Newmann & Son, Preston, Minn., died recently. He was unmarried, and is survived by his parents and one brother.

John H. Curtis, 65, a veteran in the cement-manufacturing industry, was killed at Louisville, Ky., when his automobile was struck by an interurban car. Mr. Curtis retired to his Kentucky farm about 15 years ago. Before that he had been connected with the Indiana Portland Cement Co. at Greencastle, Ind., and other operating concerns in Kentucky, Oklahoma and Indiana.

John A. Hall, aged 70, president of the Western Granite Co., Inc., of Seattle, Wash., died recently.

Homer L. Zipp, for many years a lime and crushed-stone producer in the vicinity of Petoskey and Charlevoix, Mich., died after a two-year illness at his home in Grand Rapids. He was a native of Canada and was connected with the lumbering industry in northern Michigan for many years. He was 62 years of age.

Floyd Million, age 66, pioneer Indiana sand-and-gravel producer, died at his home at Lake Cicott recently after an illness of 16 months. With his son, Frank, Mr. Million operated the Million Sand & Gravel Co. at Lake Cicott for more than a decade and early this year, due to his lingering illness, the operations were sold to the American Aggregates Co. of Greenville, O. Besides the widow and son, Mr. Million is survived by two daughters and a sister, all Indiana residents. Burial took place at Burnettsville, Ind.

Floyd Million.

Traffic News and Comment

Recent I. C. C. Decisions

Calcined Magnesite.—The commission has found that the rate on imported calcined magnesite in bags, from Brooklyn, N. Y., to Memphis, Tenn., was unreasonable, but not unduly prejudicial, to the extent that it exceeded or may exceed 63c., car-load minimum weight 40,000 lb. The new rate is to be made effective not later than June 23. Reparation was awarded. (See PIT & QUARRY, Aug. 12, 1931, p. 69 and Dec. 16, 1931, p. 109.)—I.C.C. Docket No. 24,521, Memphis Freight Bureau *et al. v.* Pennsylvania *et al.*

Crushed Stone and Sand.—The commission has found the rates on crushed stone and sand from Stone Siding, Md., to destinations in Pennsylvania within 200 mi. of Stone Siding, unreasonable to the extent that they exceeded or may exceed rates made by use of the mileage scale shown below. New rates are to be made effective not later than June 20.—I.C.C. Docket No. 23,335, Cumberland Cement & Supply Co. *v.* Pennsylvania.

Miles	Rate	Miles	Rate
15	$0.60	100	$1.10
25	.70	125	1.20
40	.80	150	1.30
60	.90	175	1.40
80	1.00	200	1.50

Examiners' Reports

Raw Dolomite.—Examiner W. B. Wilbur recommends that the commission find the rate on raw or crude dolomite from McVitty's, O., to Fairmount, W. Va., unreasonable to the extent it exceeded or may exceed $2.10 a net ton, and prescribe this new rate and award reparation. (PIT AND QUARRY, Oct. 21, 1931, p. 77.)—I.C.C. Docket No. 24,705, Owens-Illinois Glass Co. *v.* B. & O. *et al.*

Plaster-board.—Examiner C. W. Griffin, in recommending a revision in the rates and minimum weights on plaster-board in Western Trunk Line territory, said that the commission should make the following findings:

1. That the rates assailed on plaster-board, in car-loads, from Fort Dodge to points in Western Trunk Line territory, as defined in Appendix G to Western Trunk Line Class Rates, 164 I.C.C. 1, are unreasonable to the extent that they exceed rates based on 20 per cent. of the corresponding first-class rates.

2. That the rates assailed on plaster-board in car-loads, from Fort Dodge, Southard and Sweetwater to points in the southwest, are not unreasonable.

3. That the rates assailed on plaster-board, in car-loads, from Southard and Sweetwater to destinations in Western Trunk Line territory, as defined in Upson Co. *v.* Ann Arbor, 157 I.C.C. 586, to which the rates are based on 20 per cent. of the corresponding first class rates, are not unreasonable, but that the rates to other destinations in Western Trunk Line territory, as defined in Appendix G to Western Trunk Line Class Rates, 164 I.C.C. 1, are unreasonable to the extent that they exceed rates based on 20 per cent. of the first-class (Column 100) rates under the Southwestern scale set forth in Appendix 18 to the report in Consolidated Southwestern Cases, 123 I.C.C. 203.

4. That the minimum weights in connection with the rates on plaster-board, in carloads, from Fort Dodge, Southard and Sweetwater to points in Western Trunk Line and Southwestern territories are unreasonable to the extent that they exceed 40,000 lb.

5. That, so far as it applied to mixed shipments of plaster and plaster-board, the mixed-carload rule assailed is not unreasonable. This finding should be without prejudice to further consideration following disposition of Investigation and Suspension Docket No. 3,588, Plaster from the Southwest to Interstate Destinations.

In the report he states that there is insufficient evidence on which to base a recommendation of reparation, although he has found several of the rates unreasonable. The complaint alleged that, compared with like traffic in the opposite direction from California, the rates on plaster-board from the points of origin involved in the complaint to points in California and other points in trans-continental territory were unduly prejudicial to complainants' plants at Fort Dodge, Southard and Sweetwater and unduly preferential of the California producers. However, no finding is proposed with respect to this allegation since the examiner said it appeared that the present adjustment from Fort Dodge to all Pacific ports and from Southard and Sweetwater to the south Pacific ports was satisfactory to both defendants and complainants. He further stated that he would expect rates established from Southard and Sweetwater to the north Pacific coast ports to be properly related to the Fort Dodge rates.—I.C.C. Docket No. 23-823, Gypsum Assn. *et al v.* A. T. & S. F. *et al.*

Rate-Committee Dockets

New England Freight Assn.

Crushed Stone.—To meet existing contracts made prior to the effective date of the emergency charge, shippers propose a reduction of 6c. per ton in the rate of $1.10 applying on crushed stone,[1] in open-top cars, from Westfield, Mass., to White Plains, N. Y.—Docket No. 24,898.

Feldspar.—To enable shippers to meet competition from Penland, N. C., carriers propose to reduce the rate on feldspar, car-load minimum weight 60,000 lb., from McArthur, Que., to Manchester, Conn., from 33c. to 25½c. per 100 lb.—Docket No. 24,426.

To restore a relationship with rates from Keystone, S. D., that has existed for several years, shippers propose that the rates on feldspar, as described in Item 655 of Van Ummersen's I.C.C. No. 180, from Bates, Dunns, Littlefield, Lockes Mills and South Paris, Me., to Sheboygan, Wis., and other points in above tariff taking the rate basis 100, be reduced from 33½c. to 32c.; intermediate territory to be scaled in the regular manner; proposed rate to apply via differential routes only.—Docket No. 24,918.

Sand and Gravel.—To meet both barge and truck competition carriers propose to reduce the rate on common sand and gravel, car-load minimum weight 50 net tons, from Littleton and Bedford, Mass., to Boston, Cambridge, Somerville and West Cambridge, Mass.; from Gleasondale, Maynard, South Acton, Topsfield, Wayland and West Concord, Mass., to Belmont, Boston, Cambridge, Somerville, Waltham, Waverly, and West Cambridge, Mass.; from Gleasondale and Lancaster, Mass., to Worcester, Mass., from 50c. to 45c. per net ton, to expire Mar. 31, 1933.—Docket No. 24,946.

Trunk Line Assn.

Crushed Stone, Sand and Gravel.—To meet truck competition carriers propose to reduce the rate on crushed stone, sand and gravel,[1] from Otisville, N. Y., to Orange Farms, N. Y., to 50c. per net ton, to expire Nov. 1, 1932.

To meet truck competition, shippers propose that the crushed stone,[1] from Cumberland, Md., to Oldtown, Md., be reduced from 70c. to 50c. per net ton, and that the rate on common sand and gravel,[1] from Cumberland, Md., to Town Creek, Md., be reduced from 70c. to 64c. per net ton, both rates to expire Mar. 31, 1933.

Lime.—Shippers are proposing the establishment, as commodity rates on (A) Lime, except agricultural and fluxing, and dry mortar, car-load minimum weight 40,000 lb., and (B) agricultural or fluxing lime and ground limestone, car-load minimum weight 50,000 lb., from Group 1 stations (Plymouth Meeting, Blue Bell, Bainbridge, Pa., Texas, Md., and other stations taking the same rates) and from Group 2 stations (Bellefonte, Pa., Pa., Martinsburgh, W. Va., group) to destinations in New England on the B. & A., C. Vt., B. & M., N. Y., N. H. & H. and the Rutland, of the following basic rates. (A complete list of origins and destinations will be fur-

nished on request.)—Docket No. 28,912.

From Group 1

To—	(A)	(B)
Pittsfield Basis	19 c	17 c
New Haven Junction Basis	21½c	18½c
Highgate Springs Basis	23 c	19 c

From Group 2

To—	(A)	(B)
Pittsfield Basis	21 c	18 c
New Haven Junction Basis	22 c	18½c
Highgate Springs Basis	23 c	19 c

Carriers are proposing to increase the rates on lime and ground limestone from origins in eastern Pennsylvania, New Jersey, Maryland and West Virginia, to Bedford, Bath Beach, Coney Island and stations, 39th St., and 3rd Ave., to Gravesend, N. Y. A complete copy of exhibit will be furnished on request.—Docket No. 28,914.

Central Freight Assn.

Amiesite.—Shippers are proposing a line of rates on crushed stone, coated with oil, tar or asphaltum, from Kenton, O., via the N. Y. C. to various destinations in Michigan. Representative proposed rates are: Fennville, $2.57; Flint, $1.99; Grand Haven, $2.57; Grand Ledge, $2.11; Grand Rapids, $2.34; Howard City, $2.34; and Howell, $1.88 a net ton.—Docket No. 30,981.

Agricultural Limestone.—A reduction in the rate on agricultural limestone in box-cars, car-load minimum weight 50,000 lb., from Gibsonburg and Woodville, O., to Chicago, Ill., from $2.80 to $2.30 a net ton is proposed by shippers.—Docket No. 30,934.

Crushed Stone.—Shippers are proposing a reduction in the rate on crushed stone, ex-lake, from Lorain, O., to Barberton, O., from 80c. to 70c. per net ton.—Docket No. 30,941.

It is proposed by shippers to reduce the rate on crushed stone from Bellevue, O., to Homer and Medina, O., from 80c. to 75c. a net ton.—Docket No. 30,971.

Dolomite.—Carriers propose to reduce the rate on raw dolomite,[1] from Carey, O., to Fairmount, W. Va., from $2.65 to $2.25 a net ton.—Docket No. 30,894.

Carriers propose to establish a commodity rate of $1.39 per net ton on raw dolomite from Evansville, Ind., to Alton, Ill.—Docket No. 30,940.

Ground Limestone.—Shippers at Apex, O., are proposing establishment of the following rates on stone dust, ground or pulverized limestone, in bulk or in bags, barrels or boxes, in closed cars, car-load minimum weight 50,000 lb., to: Acosta, Pa., 12c.; Barrackville, 10c.; Bryce, W. Va., 14c.; Canonsburg, Pa., 8c.; Carolina, W. Va., 8c.; Charleston, W. Va., 14c.; Clarksburg, W. Va., 11c.; Consolidation No. 32, Fairmount, Farmington, and Grand Town, W. Va., 10c.; Gray (Lycoming Co.), 14c.; Gray (Somerset Co.), 12c.; Gray (Westmoreland Co.), Pa., 11c.; Juno, W. Va., 16c.; McDonald, Pa., 8c.; Mill Creek, W. Va., 13c.; Monongah and Monongahela, W. Va., 10c.; Morgantown, W. Va., 11c.; New Kensington, Pa., 10c.; Pittsburgh, Pa., 9c.; Rivesville, W. Va., 10c.; and Venice, Pa., 8c.—Docket No. 30,933.

Lime.—Shippers propose the establishment of a rate on hydrated lime, car-load minimum weight 50,000 lb., from Indianapolis (Speedway), Ind., to Cattlesburg, Ky., of 16c., in Docket No. 30,987; and a rate of 19½c. to Franklin, Pa., in Docket No. 30,988.

Shippers at Painesville, O., are proposing the establishment of commodity rates on fluxing lime, having no commercial value for chemical or building purposes, car-load minimum weight 30,000 lb., to destinations in Ohio, based on 80 per cent. of the contemporaneous rate applicable on common lime.—Docket No. 30,992.

Sand.—Shippers at Cleveland, O., are proposing that the rates on common sand in open-top cars be reduced to $1.00 to New Castle, Pa.; to $1.40 to West Newton, Pa.; and to $1.60 to Uniontown, Pa.; all per net ton.—Docket No. 30,970.

Sand and Gravel.—A reduction in the rate on common sand and gravel from Indianapolis, Ind., to Waveland and Brown's Valley, Ind., from 95c. to 80c. per net ton, to expire six months after the effective date is proposed by shippers.—Docket No. 30,913.

Carriers propose to reduce the rate on common sand and gravel from Ginger Hill and Rupel, Ind., to Walkerton, Ind., from 62c. to 50c. a net ton.—Docket No. 30,995.

Western Trunk Line Committee

Cement.—Shippers propose the establishment of a rate on cement, car-load minimum weight 80,000 lb., of 11½c. per 100 lb., from Bonner Springs, Kan., to Omaha, Nebr. The present rate is 13½c. for a car-load minimum weight of 50,000 lb.—Docket No. 5,059-C.

Crushed Stone, Sand and Gravel.—It is proposed to change the minimum weight applicable of crushed stone, sand and gravel and other low-grade heavy-loading commodities between stations in W. T. L. and S. W. L. territories, and between points in W. T. L. and points in S. W. L. territories. The present car-load minimum weight is 90 per cent. of the marked capacity of the car, except that when the car is loaded to its full cubical or visible capacity, the actual weight will apply. It is proposed to change the minimum weight by substituting for "90 per cent. of marked capacity," the words, "the marked capacity."—Docket No. 3,350-E.

Sand and Gravel.—To establish through commodity rates on sand and gravel, from Mason City, Ia., to destinations on the C. & N. W. and C. M. St. P. & P. in southwestern Minnesota, it is proposed to add to Item 2,180-C of W. T. L. Tariff 13-P the joint-line mileage scales shown in Item 2,200 of the tariff.—Docket No. 365-D.

Southern Freight Assn.

Cement, Lime and Plaster.—It is proposed to amend Item 62 of note "A" exceptions to southern classification, Agent Dulaney's I. C. C. No. 40 to read as follows: "Mixed car-loads of cement, lime and/or plaster will be subject to the highest car-load minimum weight (see Note 1) applicable on any commodity included in the mixture. The car-load rate will be charged on the actual weight of each commodity and the deficit necessary to make up the required minimum weight will be charged for at the highest rate assessed on any of the commodities included in the mixture. In no case shall the total charges on any shipment be less than the highest minimum car-load charge on any article contained in the shipment when in straight car-loads. [Note 1.—Where alternate rates and minimum weights apply on lime, the charge for the weight of lime in the mixed car-load shall be obtained by the use of the rate applicable thereon at the lowest minimum, except that the charge for the lime shall not exceed that which would be assessed if taken as a straight car-load.]" It is also proposed to substitute the suggested rule for that now applicable under Item 40 of Florida Intrastate Exceptions to Southern Classification, Agent Dulaney's I. C. C. No. 30.—Docket No. 57,294.

Southwestern Freight Bureau

Crushed Stone, Sand and Gravel.—(See Western Trunk Line Committee Docket No. 3,350-E.)

Transcontinental Freight Bureau

Sand.—Shippers request the establishment of a commodity rate on silica sand, car-load minimum weight 80,000 lb., from Brown and Ceneda. Cal., to group "A" and west, in Tariff 3-E, of 90c. per 100 lb.—Docket No. 13,512.

[1] The car-load minimum weight will be 90 per cent. of the marked capacity of the car, except that when loaded to its full cubical or visible capacity, the actual weight will apply.

Cuban Producer Ships Cement into Venezuela

Outside markets are being sought by the Cuban Portland Cement Co., an intensive sales campaign being under way in Venezuela and Central American states. The company's ocean-going self-unloading steamer *Holgar Struckmann* recently made its initial trip, carrying a cargo of cement from the company's plant at Mariel to Venezuela.

A Correction

The exhibit of the Frog & Switch Manufacturing Co. of Carlisle, Pa., at the 1932 convention of the National Crushed Stone Assn. at Pittsburgh was briefly described by PIT AND QUARRY as including "various track accessories, parts and literature." The company's exhibit, however, contained equipment of a different character. Pulverizer hammers, screen bars, tractor lags, grizzly bars, chain, bushings, pins, points and bases were on display.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Bond Deposit Time for Asbestos Corp. Extended

The time for the deposit of securities of the Asbestos Corp, of Montreal, under the proposed reorganization plan, which expired March 31, was extended to April 15. More than the required percentage of bonds and stocks has now been deposited in favor of the plan, it is reported.

Dolese & Shepard Omits Its Quarterly Dividend

Dolese & Shepard Co., one of the leading producers of aggregates in the Chicago territory, has omitted the quarterly dividend of $1.00 on the common stock of the company due at this time. Unsatisfactory earnings and the desire to conserve the company's cash were the reasons given for the omission.

International Cement Co. 1931 Net $2.13 a Share

International Cement Corp. has issued its pamphlet report for the year ended December 31, 1931, showing net income of $1,358,213, after federal taxes, depreciation, depletion and other charges, equivalent to $2.13 a share on 636,450 no-par shares of capital stock. This compares with $4,539,509, or $7.14 a share on 635,798 shares, in 1930.

Current assets as of December 31, 1931, including $2,445,858 cash, were $9,711,528 and current liabilities were $1,368,048. At end of 1930, cash and marketable securities amounted to $3,831,795, current assets $11,692,899 and current liabilities $1,914,243.

Income Account

	1931	1930
Sales	$20,087,148	$27,037,855
Exp., depr. & depletion	17,530,961	20,908,078
Profit	$ 2,556,187	$ 6,129,777
Other income	298,049	346,290
Total income	$ 2,854,236	$ 6,476,067
Int., fed. tax, etc	1,496,023	1,936,558
Net income	$ 1,358,213	$ 4,539,509
Pfd. dividends	.....	.....
Com. dividends	2,357,015	2,529,289
Sub. dividends	294	609
Deficit	$ 999,097	*$ 2,009,611
P. & L. surplus	12,699,738	14,852,557

* Surplus.

Assets

	1931	1930
**Plt., eq., etc	$42,437,022	$43,413,733
Cash	2,445,858	3,818,616
Notes & Accts. receivable	2,524,995	2,765,132
Marketable securities	.....	13,179
Other investments	§642,812	254,818
Inventories	4,740,674	5,874,585
Deferred charges	1,459,914	1,534,777
‡Deduct reserves	.....	778,613
Total	$54,251,275	$56,896,227

Liabilities

Common stock	†$21,885,342	$21,850,985
Sub. co. stock	8,250	11,630
Funded debt	17,995,500	17,995,500
Accts. payable	674,799	1,096,317
Prov. for taxes	356,000	459,752
Accrd. int., etc	337,249	358,175
Insur. res	88,234	39,504
Emp. stk. sub	26,933	76,367
Sub. surplus	179,230	155,439
Surplus	12,699,738	14,852,557
Total	$54,251,275	$56,896,227

** After depreciation, depletion and other property reserves. † Represented by 636,450 no-par shares. ‡ Reserve for loss on exchange on net current assets in South America. § Includes 9,400 shares of common stock of International Cement Corp. amounting to $350,100.

The company during 1931 granted licenses for the manufacture of "Incor" cement for Denmark, Norway, Sweden and Finland, and negotiations are practically completed for licensing one of the leading cement companies in Australia.

"The demand for 'Incor,' a high-early-strength cement, continued to increase during 1931," Holger Struckmann, president, said, "and it was deemed advisable to equip the Dallas, Tex., plant with facilities for manufacturing this product, thus providing facilities for the manufacture of 'Incor' cement in five states, viz., Pennsylvania, Indiana, Kansas, Texas and Alabama."

Capital expenditures of International Cement during 1931 totaled $2,137,023, the major items of which were as follows: Work on construction of 1,000,000-bbl. plant near Rio de Janeiro, Brazil, scheduled to be completed by latter part of the current year; installation of two 400-ft. kilns with necessary coolers and grinding equipment at the Houston, Tex., plant; installation of necessary equipment for production of "Incor" cement at the Dallas plant; installation of bulk-loading facilities at five domestic plants; installation of power and packing equipment on the Cuban subsidiary's bulk-loading motor-ship.

Canadian Operator Has Smaller Deficit in 1931

Net profit of Gypsum, Lime & Alabastine, Canada, Ltd., for the year ended December 31, 1931, was $39,237 after interest, depreciation, depletion, income taxes, bad debts and exchange reserves, comparing with $308,364 in 1930. Deficit after dividends for 1931 was $186,159 against a deficit of $285,939 in preceding year.

Current assets as of December 31, 1931, amounted to $1,451,339 and current liabilities were $313,052.

Campaign Urges Use of Quick-Hardening Cement

Saving of time and money is the appeal being used by the International Cement Corp. in its publicity campaign urging the use of "Incor," the company's brand of high-early-strength Portland cement.

One of the thoughts expressed in the company's advertising is that merchants are losing $300,000,000 in sales each year because paving in front of their places of business is done with ordinary cement, which requires from 5 to 10 days after placing before it can be opened to traffic, instead of 24 hours with high-early-strength materials.

Saving to car owners through the elimination of detours which often cause break-downs and always lengthen the distance to be traveled, consequently requiring more gasoline and oil, is another appeal being used in International's advertising copy.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE	COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Preferred	$1.75 qr.	Mar. 1	Mar. 15	National Gypsum Co	Preferred	$1.75 qr.	Mar. 19	Apr. 1
Arundel Corp	Common	$0.75 qr.	Mar. 23	Apr. 1	Owens-Illinois Glass	Preferred	$1.75 qr.	Mar. 16	Apr. 1
Boston Sand & Gravel	Common	$0.15 qr.	Mar. 22	Apr. 1	Pacific Portland Cement	Preferred	$1.62½ qr.	Mar. 31	Apr. 5
Boston Sand & Gravel	Preferred	$0.87½ qr.	Mar. 22	Apr. 1	Pennsylvania Glass Sand	Preferred	$1.75 qr.	Mar. 25	Apr. 1
Calaveras Cement	Preferred	$1.75 qr.	Mar. 31	Apr. 1	Pittsburgh Plate Glass	Common	$0.25 qr.	Mar. 10	Apr. 1
Canada Cement	Preferred	$1.62½ qr.	Feb. 29	Mar. 31	Superior Portland Cement	Class A	$0.27½M	Mar. 23	Apr. 1
Dufferin Pav. & Crushed Stone	Preferred	$1.75 qr.	Mar. 24	Apr. 1	Texas Gulf Sulphur	Common	$0.50 qr.	Mar. 1	Mar. 15
Hazle Atlas Glass	Common	$0.25 extra	Mar. 19	Apr. 1	U. S. Gypsum Co	Preferred	$1.75 qr.	Mar. 15	Mar. 31
International Cement	Common	$0.50 qr.	Mar. 11	Mar. 31	U. S. Gypsum Co	Common	$0.40 qr.	Mar. 15	Mar. 31
International Salt	Common	$0.50 qr.	Mar. 15	Apr. 1	Wallace Sand, Ltd.	Preferred	$1.50 S.A.	Mar. 31	Apr. 15
Johns-Manville	Preferred	$1.75 qr.	Mar. 11	Apr. 1	Warner Co.	1st Pfd.	$1.75 qr.	Mar. 15	Apr. 1
					Worcester Salt	Common	$1.25 qr.	Mar. 24	Mar. 31

Review of Foreign Practice

New Cement Mill Being Erected in Madagascar

The island of Madagascar has been in a bad situation for construction on account of lack of building-material supplies, for even wood suitable for any but the smallest structures is rather rare. For concrete construction cement has been imported from France, Belgium, England and Norway, but as there is a part of the island where the necessary raw materials are available the Société Anonyme des Chaux et Ciments de Madagascar has recently been organized and is now constructing a plant which will produce cement locally.

This plant is under construction at Amboanio in the estuary of Betsiboka River, some 20 km. above Majunga. The raw materials available are a soft chalk-like limestone, easy to grind, and a good slip clay. These materials have been carefully tested, and cement made from specimens has tested high. The plant will have a capacity of 50,000 metric tons, using one rotary kiln and operating by the wet process. Electrical equipment has been provided for driving the operating units without the use of belts, because of the damp and hot climate. All units of the plant are arranged for easy doubling of capacity by the installation of duplicate units. The power will be furnished by Diesel engines driving generators. Fuels both for calcining and for power will be imported, but can be delivered from Durban and Monbassa to the plant docks for about the same price as that obtaining at most plants in Europe. The plant will have complete laboratory facilities for controlling the quality of the product. It is expected that its products will be used not only in Madagascar but also in Reunion, Mauritius and the African coast from Mombasa to Durban.—*Mines, Carrieres, Grandes Entreprises*, 11:29-32, Feb., 1932.

Consider Use of Brick Kilns for Burning Lime

Many brick kilns are operated at capacities so comparatively low that it is desirable to find some auxiliary employment for them, provided no additional capital expenses are involved. One interesting possibility is the burning of lime, partly because limestone deposits frequently are found in the vicinity of brick clay deposits and partly because the sale of lime for mortar can be handled by the same organization. The ring kilns so much employed in Germany for burning brick can be adapted without a great deal of difficulty for burning lime, although several points must be taken well into consideration. One requirement is that the kiln be well protected with high-resistant refractory, as the calcining temperature of lime is higher than the temperature required for baking brick; in the case of limestones with comparatively high percentages of silicates, however, the burning temperature is lower than in the case of white lime.

Again, the burning of lime liberates large quantities of the heavy gas carbon dioxide, so that care must be exercised to provide a sufficient draft, greater than otherwise required in ring kilns. The placing of the limestone offers some problem; as it shrinks on calcining it is not practical to place the green bricks on top of it, and it is necessary to space the brick and stone separately. If they are burned in separate compartments the limestone should not be placed in the corner compartments where the draft is low. Another consideration is size; since higher temperatures are required for thoroughly calcining lumps of limestone it is essential not to use stone of too large size. Marl that is formed into briquettes in the brick presses is particularly adaptable to burning in the ring kilns.—*Tonindustrie-Zeitung* 56:150-151, Feb. 4, 1932.

Change German Standards for Sizing of Materials

The second draft of German specification D. I. N. 1179 for the sizing of sand, gravel and crushed stone appeared late in 1930, but has attracted little attention from the industry, which is particularly surprising because of certain points in which it does not correspond to the industry's needs. One improvement it offers in contrast to the former specifications is that each size is defined as passing a certain screen and retained on another: for instance, a 30 to 40-mm. gravel or stone is one passing the 40-mm. and retained on the 30-mm. screen. This definition has been the customary one among German producers, but not among German users, and since such a stone or gravel may include particles whose smallest diameter is less than 30 mm. and whose greatest dimension is greater than 40 mm., this situation has been the basis of most of the controversies between the sellers and buyers of gravel or stone. It is, therefore, a welcome improvement that the materials are definitely specified as determined by the screens they pass and on which they are retained, rather than the minimum and maximum dimensions of any particles they contain.

The present draft specifies as test screens, for sizes up to 1 mm. the square-mesh screens standarized in a previous German specification (D. I. N. 1171), and for larger sizes round-hole screens of 1, 3, 7, 10, 15, 20, 30, 40, 50, 60 and 70 mm. diameter (one millimeter being approximately 0.04 in.). The tendency of the industry, however, is undoubtedly toward square-mesh screens, and although it is possible to plan a plant with square-mesh screens so that the products will pass the required specifications on the basis of any separation made with round-hole screens, it would obviously be much simpler if the plant screens and the test screens were in agreement. An even more important change in the specifications for standard testing screens would be to adopt screens in a series progressing at the ratio of 2:1—that is, each screen being twice the diameter of the one before, since the test results with such screens could easily be evaluated according to the Abrams fineness modulus, which is finding increasing favor in Germany. This would call for a series of screens of 1, 2, 4, 8, 16, 32 and 64 mm. mesh opening, which could be supplemented with a series with mesh openings of 3, 6, 12, 24 and 48 mm.

The proposed nomenclature for sand, gravel and stone sizes is also objectionable because of the great diversity of names proposed. It would seem much better to limit the names to a few, calling for instance all crushed stone above 30 mm. (1.2 in.) simply "Steinschlag" or "Schotter" and specifying the subdivisions by the numerical divisions involved, such as "Schotter 30-40" or "Schotter 60-70."—Ing. Rothfuchs in *Steinindustrie* 27:36-37, Mar. 3, 1932.

First Pneumatic Cement Unloader in Operation

What is said to be the first installation of a portable Fuller-Kinyon pump in Europe was recently made at Poissy near Paris for unloading bulk cement from a barge. The cement is loaded into the barge at the Gargenville cement plant by means of a stationary pump of the same system. The unloading pump which operates on the boat at the unloading dock has a capacity of 20 tons an hr., conveying a distance of 125 m. and to a height of 23 m. The installation was made by Claudius Peters of Hamburg, Germany, European representative of Fuller-Kinyon. — *Tonindustrie-Zeitung*, 56:312, Mar. 14, 1932.

Recent Patents

AMERICAN

Crushing and Grinding

Pulverizing mill and the like. Edward M. Green and George R. Unthank, London, England, assignors to R. & H. Green and Siley Weir Ltd., same place. No. 1,849,871.

Jaw-type rock crusher. Edward L. Kropp, Portland, Ore., assignor to Western Road Machinery Co., same place. No. 1,849,935.

Drilling

Rock-drill of the valveless type. Alfred G. Slatcher, Cleveland, O., assignor to Cleveland Rock Drill Co., same place. No. 1,849,208.

Rock-drill. Samuel B. Creveling and Edward Grandmason, Tremont, Pa. No. 1,849,541.

Excavating

Dipper-trip operating mechanism. Erich H. Lichtenberg, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,850,113.

Combined power-operated dipper-trip and tag-line. Harold E. Brey, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,850,167.

Trench-excavator construction. George A. Vaughn, Newton, Ia., assignor to Parsons Co., same place. No. 1,850,303.

Excavator bucket and cleaner construction. George A. Vaughn, Newton, Ia., assignor to Parsons Co., same place. No. 1,850,364.

Tripping mechanism for dumping scoops. Robert R. Downie, Beaver Falls, Pa., assignor to Keystone Driller Co., same place. No. 1,850,539.

Loading

Loading machine. Louis F. Snyder, Philadelphia, Pa., assignor to Link-Belt Co., Chicago, Ill. No. 1,850,814.

Loading apparatus. Leonard W. Holme, Bowral, N.S.W., Australia. No. 1,849,671.

Screening and Washing

Sand separator and blender. George Braun, St. Louis, Mo. No. 1,850,375.

Sand washer. George W. Cole, Encanto, Cal. No. 1,850,535.

Unclassified

Lime slaker. William J. Kuntz, York, Pa. No. 1,849,462.

Reciprocating or jigging conveyor and loader therefor. George H. Ernsbarger, Huntington Park, Cal., assignor to Goodman Mfg. Co., Chicago, Ill. No. 1,850,582.

Mining machine. Frank A. Lindgren, Western Springs, Ill., assignor to Goodman Mfg. Co., Chicago, Ill. No. 1,850,681.

FOREIGN

Blasting and Explosives

Explosive. E. von Herz, Köln-Dellbrück. German 543,174.

Blasting cartridge. J. Meissner, Burbach. German 545,235.

Blasting cartridge for percussive detonation. W. Eschbach and H. Wippenhohn, Troisdorf, Cologne. German 545,414.

Explosive. A. G. Gorst. Russian 23,207.

Explosive. Chile Exploration Co., New York, N. Y., assignee of George St. John Perrott, Pittsburgh, Pa., and George Burkle Holderer, Scarsdale, N. Y. Canadian 320,556.

Method of producing explosive. E. von Herz. British 367,713.

Cement

Reduction of the necessary fluid content of cement raw slurry. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 543,541.

Process and apparatus for preventing dust-formation in burning cement. A. Andreas, Münster. German 546,054.

Concrete and Concrete Products

Manufacture of cement-composition bricks, blocks, slabs, and the like. G. R. Speaker & Co., Ltd., and P. C. Coombes. British 368,041.

Products made by molding cement, concrete or similar plastic masses. G. Pemetzrieder, Berlin-Tempelhof. German 544,047.

Increasing the strength of concrete. C. Grossmann, Berlin-Tempelhof. German 545,319.

Crushing and Grinding

Pulverizing-apparatus. British Jeffrey-Diamond, Ltd. (Jeffrey Manufacturing Co.) British 368,614.

Pulverizer. Frederick Lindley Duffield, London, England. Canadian 320,689.

Pulverizing apparatus. Fuller Lehigh Co., Fullerton, assignee of Michael D. Jones, Allentown, Pa. Canadian 320,813.

Kilns

Kilns and the like. C. A. Jensen (Bessemer Cement Corp.) British 368,015.

Rotary kiln for burning cement. H. Stehmann, Berlin-Südende. German 544,206.

Preventing accumulation of deposits in rotary kilns. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 544,876.

Horizontal or inclined washer and cooler for discharge gases from lime kilns. B. Block, Berlin-Charlottenburg. German 546,658.

Lime and Magnesia

Hydrated lime for building purposes. A. Pozzi, Milan, Italy. German 542,659.

Weather-resistant Sorel-cement material containing calcium carbonate. H. R. Schmedes de la Roche, Bremen, and C. Mathies, Hamburg. German 542,395.

Artificial magnesite. Kali-Chemie Akt.-Ges., Berlin. German 545,071.

Machine for hydrating lime. E. J. Shaut, H. R. Baker and P. S. Dickinson. French 712,778.

Material-Handling

Car dumpers. E. West and West's Gas Improvement Co., Ltd. British 367,971.

Conveyors. L. Krieger. British 367,974.

Lubricating-apparatus for conveyor chains and the like. A. R. Kirkham. British 368,068.

Jigging-mechanism for jigging conveyors and the like. Mavor & Coulson, Ltd., and J. B. Mavor.

Conveying devices. E. W. Plumley, E. C. Lysaght and J. Lysaght, Ltd. British 368,506.

Conveyor. Samuel Cote Nominique, Quebec. Canadian 320,481.

Conveyor chain and flight. Jeffrey Manufacturing Co., Ltd. Ville La Salle, Que., assignee of Nils D. Levin, Columbus, Ohio. Canadian 320,826.

Mining and Quarrying

Pit props and like supports. Bromford Tube Co., Ltd., and R. W. Spencer. British 367,800.

Mine props. W. Gliemann and W. Wendt. British 368,634.

Sacking

Making, filling and closing bags. P. Gangler and Hesser Maschinenfabrik Akt.-Ges. British 368,153.

Apparatus for filling bags with cement or other powdered or granular substances. J. Ward. British 368,417.

Bag-filling machine. Cornell Bag Corp., New York, N. Y., assignee of the Cornell Multi-Wall Valve Bag Co., East Pepperell, assignee of Arthur L. Currier, Ashburnham, Mass. Canadian 320,800.

Multi-ply bags, and methods of manufacture. A. Andreas. British 367,655.

Screening and Separating

Vibrating sieves. Salt Union, Ltd., and R. Bennet. British 368,026.

Devices for cleaning screens. R. A. Blakeborough and J. B. Blakeborough. British 368,527.

Screening apparatus. W. L. Wettlaufer. British 368,598.

Electrical-precipitation filter devices. Telex Apparatebau-Ges. m. b. H., Frankfurt a. M. German 544,084, 544,384 and 546,352.

Electrode for electrical precipitator. Siemens-Schuckertwerke Akt.-Ges., Berlin-Siemensstadt. German 544,977.

(Continued on page 57)

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Manufacturers' Publications

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Concrete Plants

Rex Moto-Mixers and Agitators for 1932. 40 p. (Cat. No. 211. Chain Belt Co., Milwaukee, Wis.) Describes and illustrates mixer and agitator trucks and pre-mixed-concrete plant equipment including elevators, conveyors, bulk-cement unloaders and plant mixers.

Heltzel Catalog No. 30. 16 p. (The Heltzel Steel Form & Iron Co., Warren, O.) Describes and illustrates equipment for the producer of ready-mixed concrete, including steel bins, weigh batchers for cement and aggregates, and scales.

Crushing and Grinding

The Answer to Your Reduction Problem. 6 p. (The Jeffrey Manufacturing Co., Columbus, O.) A mailing folder describing and illustrating the pulverizing and crushing machinery made by this concern, including hammer-mills and jaw crushers.

You're Going to Get More Than You Expect! 8 p. (Smith Engineering Works, Milwaukee, Wis.) A broadside pointing out in text and illustration the details of the Telsmith primary breaker for 1932, as well as the important advantages of one of the company's newer products—the Telsmith cone crusher.

Drilling

Loomis "Clipper" Blast Hole Drill. (The Loomis Machine Co., Tiffin, O.) A printed folder describing in brief and illustrating the mounting of a well-type drill for blast-hole work on full-length crawlers for easy access to difficult places about quarries.

Pumping

Morris Centrifugal Pumps, Dredges and Steam Engines. 12 p. (Bull. 140. Morris Machine Works, Baldwinsville, N. Y.) Outlines some of the many products of this concern, including various types of centrifugal pumps for handling water, slurry, sand and gravel, etc. Hydraulic dredges, and additional types of centrifugal pumps for high and low heads and a wide range of capacities, are also described.

Recording Instruments

Bailey Water Level Recorders. 8 p. (Bull. No. 112. Bailey Meter Co., Cleveland, O.) Describes the advantages, construction and installation methods of a water-level recorder. Illustrations show installation views and reproductions of actual chart records.

Screening

Price List No. 34. 8 p. (National Wire Cloth Manufacturing Co., St. Paul, Minn.) A new price list cataloguing various sizes and types of double-crimp, lock-mesh, spring-wire screen cloth.

Trayco Electric Products. 4 p. (Bull. S-103. The Traylor Vibrator Co., Denver, Colo.) Describes and illustrates a line of electric-vibrating screens, in single and multiple-deck models, and vibrating conveyors.

Scrubbers

Hardinge Conical Scrubber. 4 p. (Bull. No. 37. The Hardinge Co., York, Pa.) Describes and illustrates a conical scrubber designed along the lines of the conical ball-mill for use in scrubbing and cleaning gravel and stone.

Trucks and Trailers

Easton Industrial Transportation. 12 p. (Bull. No. 40. Easton Car & Construction Co., Easton, Pa.) Describes and illustrates a line of side-dump and rear-dump bodies for trucks as applied to quarry service. A list of quarries using this equipment and some interesting data on quarry-truck haulage make the booklet especially valuable; the data were obtained by means of a questionnaire.

Modern Haulage Equipment. 4 p. (Bull. No. 102. United Iron Works, Pittsburg, Kan.) Describes and illustrates a new bottom-dump trailer for use in hauling sand and gravel, crushed stone and other pit-and-quarry materials. Pneumatic tires with dual rear-wheels are featured.

Unclassified

Zweiss-Dywidag System of Reinforced Concrete Construction. 24 p. (Bull. No. 138. Roberts & Schaffer Co., Chicago, Ill.) Contains an outline and illustrations of a basically new principle in the design of reinforced-concrete structures employing the barrel or dome type of roof.

A New Process—Metallizing. 6 p. (Metallizing Company of Los Angeles, Ltd., Los Angeles, Cal.) A new process for rustproofing, weatherproofing and finishing equipment by coating it with hot metal applied by the spray-gun method is described in this circular. A wide range of uses about any type of industrial plant is suggested.

Western Crushing and Screening Equipment. 32 p. (Bull. W-32-A. The Austin-Western Road Machinery Co., Chicago, Ill.) Contains descriptions and pictures of portable crushing-and-screening plants, loading equipment, roller-bearing jaw crushers, sectional conveyors, screens and bins.

New Developments in Unburned Magnesite Brick. 12 p. (General Refractories Co., Philadelphia, Pa.) An article by A. E. Fitzgerald, ceramic engineer, in which these developments are described and illustrated.

Recent Patents

(Continued from page 56)

Device for collecting and removing the dust from electrodes of electrical precipitators. Siemens-Schuckertwerke Akt.-Ges., Berlin-Siemensstadt. German 544,077.

Electrical-precipitator devices. Siemens-Schuckertwerke Akt.-Ges., Berlin-Siemensstadt. German 545,604, 545,605 and 545,709.

Electrical purification of gases. Siemens-Schuckertwerke Akt. - Ges., Berlin-Siemensstadt. German 545,603 and 545,690.

Electrical precipitator. International Precipitation Co., Los Angeles, Cal., assignee of Harry Aber Wintermute, Plainfield, and Carl W. Julius Hedberg, E. Bound Brook, N. J. Canadian 320,586.

Slag

Preparation of blast-furnace or other porous slags as concrete aggregate. H. Schwartzkopff, Berlin. German 545,681.

Unclassified

Asbestos-cement compositions. G. Morbelli. British 367,815.

Coverings and linings for masonry. P. Falke. British 368,576.

Marble-like veined artificial stone. J. Ter Smitte, J. C. Ter Smitte and J. P. Ter Smitte, Rotterdam, Holland. German 542,485.

To License Manufacture of Equipment in Europe

The Dust Recovering & Conveying Co. of Cleveland announces the formation of a foreign-business department, and has adopted a policy of licensing foreign manufacturers in the principal industrial countries to build and sell, in their own territories, dust collecting and pneumatic-conveying equipment from its Dracco designs.

For Britain, and the Overseas Dominions, except Canada, the company has become associated with the Power-Gas Corp. Ltd., of Stockton-on-Tees, England, gas- and chemical-plant engineers and constructors, whose production facilities and engineering organization place them in an excellent position to exploit their equipment.

In order to further relations with licensees in continental Europe, an office of the Dust Recovering & Conveying Co., has been established at 77 Rue des Tanneurs, Brussels, Belgium, under the management of the engineers of Tevo, Limited, a firm whose partners have specialized for many years in the study of equipment for removing solids from gases, as well as in general consulting engineering in power and industrial fields. Preliminary engineering advice, construction details, etc., will be supplied by the Brussels office, while all final engineering layouts will be handled through the foreign department of the company in Cleveland.

New Machinery and Supplies

Tank Car for Dry Bulk Material Is Developed

The General American Tank Car Corp. in conjunction with Link-Belt Co. has developed a novel and unusual form of self-unloading tank car for the transportation of dry commodities in bulk.

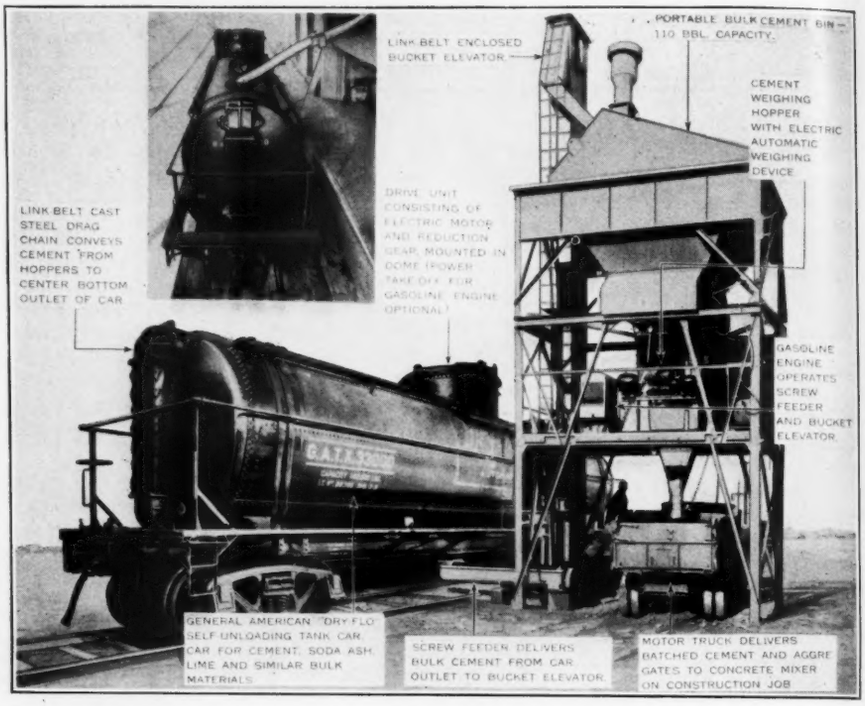
This car has been designated as the Dry-Flo by General American, prominent railroad-car builder and operator of a fleet of about 50,000 tank and refrigerator cars, leased to railroads and shippers, with the familiar "G.A.T.X." marks.

Exhaustive tests indicate that this new car is suitable for shipping virtually all types of granular commodities. Already it has handled successfully such difficult ladings as cement, and dolomite, as well as pebble-lime, hydrated-lime, and soda-ash. It is also suited for handling sulphur, arsenic, fertilizers, cleaning compounds, glass sands, pottery clays, fuller's earth, and dozens of other commodities of vast industrial importance.

In outward appearance the Dry-Flo car is much like the tank car, save that it has six openings for loading in the top instead of one. Like the tank car, too, it unloads through a single opening in the bottom, and does it automatically.

The single bottom outlet lends itself to simple conveying methods for carrying material from the car. It saves time in unloading, it prevents losses, and it is said to be better than a hopper car with many outlets.

Inside, the Dry-Flo car is different. It is divided into three compartments, two large compartments which carry the lading, while a small one houses the machinery by which it is unloaded. This mechanism is simple, fool-proof and highly effective. It consists of power-driven drag chain conveyors, which are pulled along toward the center outlet by means of sprockets located in the center compartment. The conveyors are driven by a motor located in the dome, or by external power applied to a shaft provided for that purpose. An ingenious gear speed-reducer makes it possible to operate the conveyor chains very slowly. Provision is made for throwing out power on one end of the car, should it be desired to unload it at a lower rate of speed, and also for starting one end at a time, should the lading be unduly packed, or frozen.


PORTABLE BULK CEMENT BIN — 110 BBL. CAPACITY
LINK-BELT ENCLOSED BUCKET ELEVATOR
CEMENT WEIGHING HOPPER WITH ELECTRIC AUTOMATIC WEIGHING DEVICE
LINK-BELT CAST STEEL DRAG CHAIN CONVEYS CEMENT FROM HOPPERS TO CENTER BOTTOM OUTLET OF CAR
DRIVE UNIT CONSISTING OF ELECTRIC MOTOR AND REDUCTION GEAR, MOUNTED IN DOME (POWER TAKE-OFF FOR GASOLINE ENGINE OPTIONAL)
GASOLINE ENGINE OPERATES SCREW FEEDER AND BUCKET ELEVATOR
GENERAL AMERICAN "DRY-FLO" SELF-UNLOADING TANK CAR. CAR FOR CEMENT, SODA ASH, LIME AND SIMILAR BULK MATERIALS
SCREW FEEDER DELIVERS BULK CEMENT FROM CAR OUTLET TO BUCKET ELEVATOR
MOTOR TRUCK DELIVERS BATCHED CEMENT AND AGGREGATES TO CONCRETE MIXER ON CONSTRUCTION JOB

Typical unloading operation showing the car being emptied alongside elevating and batching plant. Inset shows the car being loaded at a cement plant.

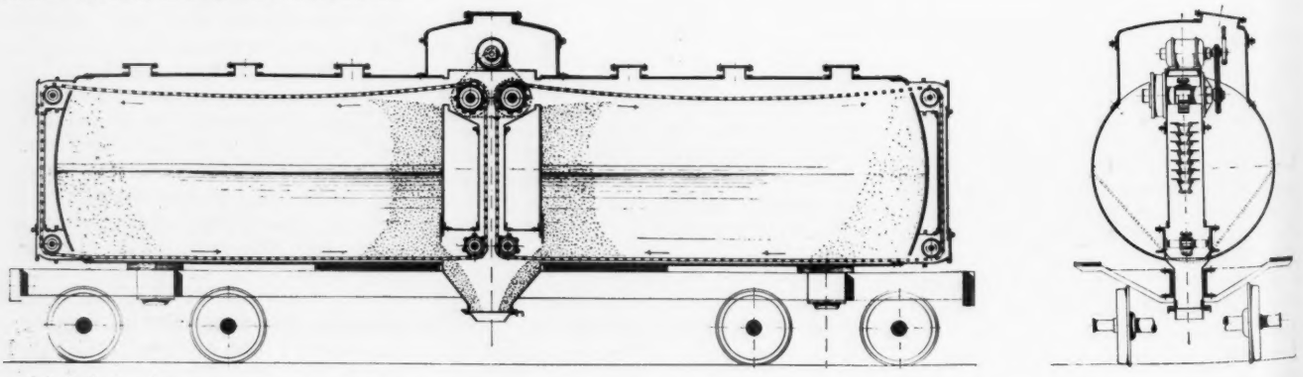
To operate this unloading equipment it is necessary only to open a valve at the bottom of the car, and connect up the motor to a source of electric power by means of a flexible cable. This done, the unloading proceeds entirely without assistance.

The car may generally be unloaded in less than two hours, varying slightly according to the commodity. This provides the discharge rate of about 400 cu. ft. per hr. using one chain, or 800 cu. ft. per hr. using both chains. Discharge is arranged to empty the car completely.

Cement has been loaded, with 65 tons to the car, in 30 min., and unloaded in less than 2 hr. Cement company officials who went out to inspect the unloading of a car returning from a long test trip, frankly admitted their surprise. They expected that "arching," so common in bins where cement is stored, would prevent the self-unloading of the cars. To their surprise it did not, even after the cars had been jolting over hundreds of miles of rails, with the lading becoming more tightly packed all the time.

Where the Dry-Flo car is substituted for sack shipment of cement, the saving of packages and labor has been estimated at $2.00 per ton, or $130.00 per trip per carload.

Savings are not confined to eliminat-



Longitudinal and cross-sections of the car showing the conveyors and bulkheads.

ing the cost of packaging, and labor of loading and unloading, however. In cases where bulk shipments are in a box car, dust is both a loss and expensive nuisance. In other cases, as of certain chemicals, handling is dangerous and so means added cost.

Estimate of savings, made for an oil company that uses hydrated lime instead of the 10 per cent. less expensive and 28 per cent. more effective quick lime, because the latter is dangerous and disagreeable for men to handle, shows a potential saving of $3,000 per month, or $1,000 per car. This is about a dozen times what it will cost to lease the car. No expensive track hopper or system of unloading conveyors is required. Merely a short screw feeder, which may be swung or rolled under the car, above the rails, to receive the material discharged from the bottom outlet, is all that is needed. The accompanying picture visualizes a typical unloading operation combining the Dry-Flo car with a Link-Belt and Blaw-Knox bulk cement batching plant. The screw feeder from the car to the bucket elevator would be a hinged or portable unit, quickly placed in position when the car is spotted at the plant. The car-unloading conveyors may be driven by the electric motor in the dome of the car, or from a gasoline engine located on the storage-bin platform.

Quick-Change Panel Is Feature of New Screen

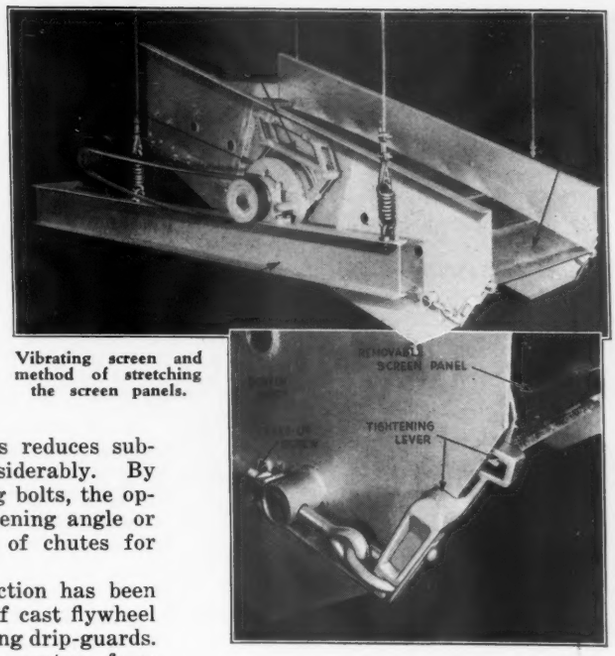
A unique quick-change screen panel is probably the outstanding feature of the new vibrator screen announced by Stephens-Adamson Mfg. Co. of Aurora, Ill. The screen is of the positive-vibration type in which the rigid screen body, with one or more decks, is given a vibration of fixed amplitude by the rapid "throw" of a heavy eccentric shaft.

The vibrator mechanism is a self-contained, factory adjusted unit. It consists of an eccentric shaft, adjustable balance wheels, heavy SKF, double-row ball and roller bearings, labyrinth grease seals and a tubular cast-steel housing.

The outstanding features of the new screen are: 1—quick-change, reversible screen panels; 2—stretching levers for screen cloth; 3—stabilizer mounting; 4—added protection for bearings; 5—cushion springs for suspension cables.

The new quick-change panel is a full-size piece of screen cloth with a stiff structural-steel angle brazed to each end. The panel is placed by sliding into position until the ends of upper cross angle drop into sockets in side frames. Stretching levers are slipped on the ends of lower angle and tightened as shown in the illustration. Installation tests indicate that two men can change or reverse a panel on any deck in about fifteen minutes.

The stabilizer unit, made up of parallel arms, holds the screen body at the desired screening angle without the use of corner balancing springs or bumpers. The unit connects screen body and subframe in such a way that the screen is free to vibrate and yet is held at a given angle. It is claimed that the elimination of bumper springs reduces subframe vibration considerably. By loosening two mounting bolts, the operator can change screening angle or tilt screen body clear of chutes for panel changes.



Vibrating screen and method of stretching the screen panels.

Extra bearing protection has been provided in the form of cast flywheel housings with overlapping drip-guards. These prevent gritty water from reaching the bearing seals and the screen can be used for washing or rinsing.

Leakage of vibration to the building is reduced by suspending the subframe from four corner cables. New cushion springs for these cables reduce the leakage still further.

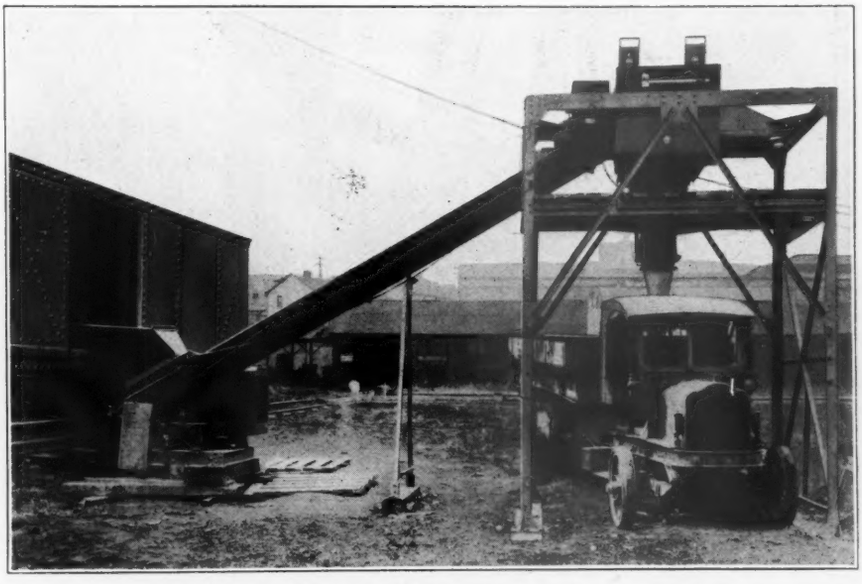
In announcing the new screen, S-A engineers emphasize the fact that each screen is furnished with a vibrating unit assembled to suit the material handled. Eccentric shafts and drives for different amplitude and frequency of vibration prevent blinding or excessive bouncing of material.

Absence of Bin Features Handy Bulk-Cement Plant

A convenient bulk-cement plant requiring no bin structure has been developed by the Blaw-Knox Co. for marketers of pre-mixed concrete, aggregates producers, and contractors who want to benefit by the economies of using bulk cement.

As the accompanying illustration shows, the hinged car hopper is adjustable to car height for the use of either buggies or scoop shovels in unloading. A 4-cylinder engine operates the enclosed screw conveyor which carries the cement up to a 1,000-lb. double-beam, cement-weighing batcher. The enclosed conveyor eliminates the dust nuisance. The weigh-batcher is equipped with springless-dial indicators which show when the batcher is full or empty.

A canvas chute controls the discharge into truck compartments. The entire plant is easily portable. Further details may be obtained by writing the Blaw-Knox Co., Pittsburgh, Pa.



The plant unloading and weighing cement from box-car to truck

New Kiln Mill Separates and Dries Product Also

Dustless and automatic operatic features the new roller mill recently introduced by the Raymond Bros. Impact Pulverizer Co. of Chicago which is equipped with air separation and air drying to operate as a kiln mill. The equipment provides a complete plant for handling finely-ground materials, feeding, grinding, drying and separating the product, as well as conveying it to storage in a single operation.

No rotary driers or auxiliaries are required in the new mill. It was able to deliver between six and seven tons of material per hour in an installation in which the raw material was a mixture of volcanic ash, silica and other ingredients with an initial moisture content of 9 per cent. All finished material passed a 20-mesh screen with approximately 90 to 95 per cent. passing 100 mesh.

The mill is ideally adapted to processing operations in the pit and quarry industries. It has thermostatic control to regulate the drying action, allowing the temperature of the system to be maintained to suit the requirements of the product. This, too, permits the safe handling of materials sensitive to extreme heat. For pulverizing combustible substances, neutral gas like CO_2 may be introduced into the mill instead of air. One of the mills, equipped in this manner, was supplied recently to an Argentina firm for grinding sulphur.

Other features include: pneumatic feed control which keeps the maximum load on the mill at all times; concentrated collectors which clean the vented air of fine dust; welded-steel seams to insure dust-tight piping and collectors; extra metal in base castings to minimize vibration; and heavy-gauge plates for increased durability.

The new Raymond mill is built in all sizes up to 40 tons per hour capacity, making it adaptable to any size of operation in the pulverized-stone, gypsum, phosphate-rock and other fields.

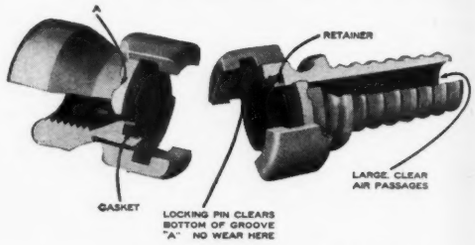
The accompanying illustration, made large so that the details of the mill and its component parts may easily be seen, shows a complete installation. Further details may be obtained by writing the Raymond Bros. Impact Pulverizer Co. at Chicago.

The new roller-mill, showing air-separating and air-drying equipment.

Quick-Acting Coupling For Use on Air Lines

For years, users of compressed air for drills and other equipment have been seeking a quick-acting hose coupling that is rugged yet easy to use. Now after tests covering nearly a year, the Cleveland Rock Drill Co. of Cleveland, O., is introducing its Type Q cadmium-plated steel coupling.

The coupling, which is most noted for its quick action, is of the snap-on type and is made of bar steel. A thick plating of cadmium provides assurance against rust. The company guarantees that they will outwear four of the ordinary type of cast couplings. A special retainer makes gasket blow-outs impossible. They can not become accidentally uncoupled; in fact, the greater the air pressure the tighter they hang on to the line. Because the device is made of heat-treated alloy steel, thinner walls are permissible and this allows a large clear opening through the entire stem. As the accompanying illustration shows, the bottom of the locking groove clears the pin, preventing wear in a spot where wear has always heretofore occurred.



New hose coupling for air lines.

The coupling is made interchangeable in two sizes—½ and ¾ in. Additional information may be obtained by writing the company.

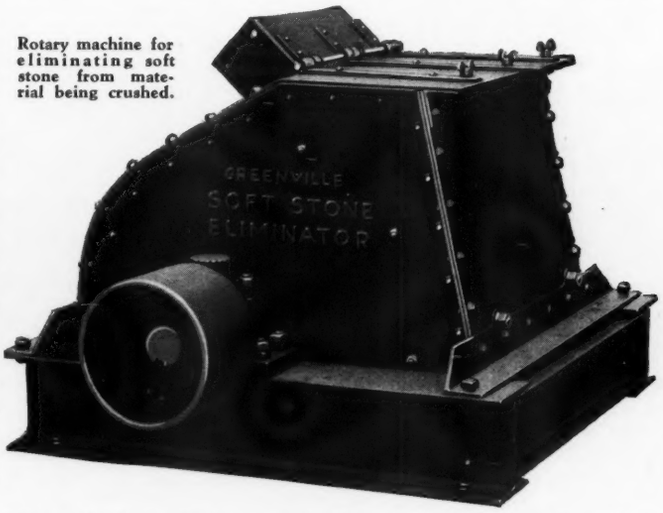
Eliminates Presence of Soft Material in Stone

During the past year, the highway departments of many states have been stressing the necessity of cleanliness of coarse aggregate to a much greater extent than ever before. For that reason the gravel and stone producers have been at their wits end, selecting suitable equipment to scrub, wash or pound their particular kind of foreign matter from their material.

In many cases these problems have been solved, especially where a certain tolerance is allowable. The deposits, however, contaning shale, hard sandstone and other deleterious substances which are almost as hard as the gravel when first taken from the pit are still looking for a solution. A

machine recently developed within the organization of the American Aggregates Corp. has given much better results than any method yet tried.

The machine illustrated on this page and known as the Greenville Soft Stone Eliminator is of the rotary type, wherein every stone receives two or three distinct hard blows as the material passes through. The speed is so regulated after installation that the soft stone is pulverized and the commercial stone is unbroken. This permits the soft aggregate to be screened out in the next operation.



Rotary machine for eliminating soft stone from material being crushed.

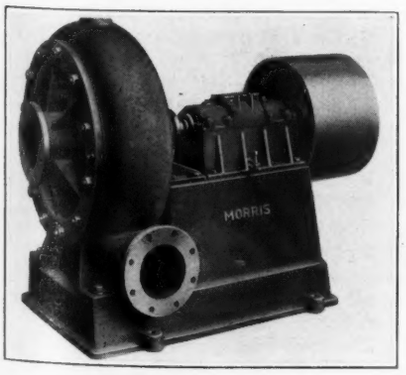
The economy of the soft-stone eliminator lies in the small space it occupies and the low power requirements. A machine about 3 ft. 6 in. square will handle 50 to 100 tons per hour and requires less than 10 hp. to operate. It naturally follows that a small unit of this type is correspondingly inexpensive in first cost.

The company does not claim 100 per cent. efficiency for this machine, but in its tests has been removing from 60 to 90 per cent. of the soft stone without injuring the marketable gravel, which greatly exceeds previous results with any other method.

The Greenville Soft Stone Eliminator is manufactured and sold by the F. M. Welch Engineering Service, Inc., Greenville, O.

Simpler Construction a Feature of Dredge Pump

Morris Machine Works of Baldwinsville, N. Y., announces that it has supplemented its line of standard, medium-duty, and heavy-duty centrifugal dredging pumps with a new pump of simpler construction, known as Type L sand pump. This unit has been developed as an inexpensive but rugged and troubleproof pump for handling sand, silt and other abrasive materials.



The Type L sand pump.

Centrifugal pumps for these severe services should be designed to provide (1) operation for long periods before requiring renewals, (2) Maintenance of initial efficiency in spite of wear, and (3) renewals at small cost and with minimum interruption to service. To meet the first standard, the parts of the new Morris Type L sand pump which are subject to wear, that is, the shell, impeller and suction disk, are heavily proportioned and made of hard semi-steel containing admixtures of nickel for resistance to abrasion and wear. To meet the second standard, the impeller assembly is designed for adjustments to take up wear. To meet the third standard, the pump parts which may require renewal after long service are designed to be inexpensive and quickly replaced.

The additional important requirement of eliminating all vibration is obtained in this new Morris design by the rigid connection between the casing and the frame, and also by the extra-large forged steel shaft supported in a double enclosed bearing, consisting of two heavy duty steady bearings with a roller thrust bearing between.

These pumps are built in sizes from 4 to 12 in. and for either belt drive or for direct connection to driver.

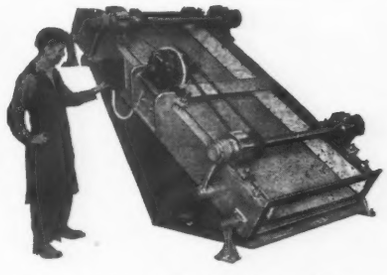
No Springs Employed in New Vibrating Screens

To meet the growing demand for better screening equipment, Stedman's Foundry & Machine Works, Aurora, Ind., equipment manufacturers for several generations, have developed a new line of vibrating screens which will hereafter be known as the Quadrex. High screening efficiency, simplicity of design and rigidity of construction are the major features of this new screen.

The screens are furnished complete with ball-bearing motor and roller-chain drive which is completely encased with a dust-tight, oil-tight casing and push-button control for the motor mounted on the side of the screen frame. All that is necessary to complete the installation after the screen is properly located and bolted in place, is to run wires to the motor, which makes the installation a simple and easy job.

The Quadrex screen is equipped with SKF ball bearings throughout and when specified can be furnished with feed-chute connection and finished product hopper.

Vibration is transferred to the well-designed, rigidly-constructed screen tray, which supports and carries the vibration to the wire cloth, through four connecting rods—one end of the connecting rod being attached to either end of two revolving shafts which have ball-bearing eccentrics on the ends. The other end of the connecting rod is attached to the shafts which support the screen tray. The loose fit of the end of the connecting rod, which is attached to the shaft supporting the screen tray, the play in this fit being about ¼ in. of the throw of the eccentric, allows the eccentric shafts, which raise each end of the screen tray 650 times a minute, to administer a second blow for every revolution of the shaft. This doubles the number of vibrations to the cloth. In addition to this, the screen is equipped with four stops under the screen tray and four stops above the screen tray, properly adjusted, so that when the eccentric shaft lowers the screen tray to its lowest position, the tray strikes the bottom stops 650 times each minute, and transfers 650 additional vibrations to the screen cloth. When the eccentric shaft raises the screen tray to its highest position, the tray strikes the top stops accordingly. This arrangement permits a great number of intensive vibrations—2600 each minute—with an unusually slow operating speed for a vibrating screen.



New screen of the vibrating-tray type.

Extreme low maintenance is a reality with the Quadrex. The manufacturer claims that several of these screens have been in service for over a year and are still operating with the original wire cloth. The general construction of this screen makes it possible to remove the screen cloth in but a few minutes.

Two sizes are offered—No. 46 which is 4 ft. wide by 6 ft. long and No. 48 which is 4 ft. wide by 8 ft. long. These screens are practical for handling large capacities and screening either fine or coarse. Bulletin No. 125, describing this equipment, will be sent upon request.

Saving Through Safety

Maintaining Interest in Safety Work

By R. R. HOWARD
National Safety Council

THE test of your plant-safety program is whether you can maintain interest in it. While the band is playing and while the safety parade is on it is easy for everybody to get into step. But will everybody keep in step? Can you sustain the original enthusiasm with which you began your plant-safety program? Can you crystallize this enthusiasm into safety progress, into real results in lessened accidents and increased working efficiency?

As a general comment it may be said that thousands of industrial organizations are sustaining interest in their plant-safety work, and they are continuously improving or at least sustaining their accident records. This is true in many different kinds of industries but it is notably true in the cement and quarry industries. A total of 129 establishments that reported to the Portland Cement Assn. for 1930 had for that year an accident frequency rate of 6.30, which is only about one-seventh of the accident rate for the cement industry in 1919. Likewise, since 1919 the cement industry has reduced its accident-severity rate to about one-third. Splendid improvements are also reported by a good many quarries. A total of 68 identical quarries that reported their accident experiences to the U. S. Bureau of Mines during the past three years of 1928, 1929 and 1930 reduced their average accident-frequency rate 26 per cent and their severity rate 61 per cent. These figures conclusively prove that it has been possible for a large number of cement and quarry plants to maintain continuous interest in their safety programs.

What are some of the possible ways in which a company may fail to maintain interest in its safety program? Also, what are some of the practical methods which are used by cement and quarry establishments to sustain interest in their safety programs?

Perhaps the best way to apply this first question to an individual plant would be to review the steps which were taken when the plant safety program was started. Then check each item of the program to see if it was properly followed through, and to see if it is now being properly carried out in accordance with the original plans.

In a pamphlet compiled a few years ago jointly by the Quarry Section of the National Safety Council and the Safety Committee of the National Crushed Stone Assn., under the title *Safety Organization for the Quarry Industry*, the following ten steps were listed as essential to proper organization for success in plant safety work:

1. *Coöperation of the manager*, in a manner to convince all supervisors and workers through such visible signs as mechanical guards, good lighting, etc., that he will do his full part in a genuine coöperative plant-safety program.

2. *Coöperation of the superintendent*, who is the field marshal of the plant safety campaign and who must be willing to prove, through unselfish activities and a display of faith and enthusiasm, that he will support his foreman and the entire plant working force.

3. *Appointment of a safety engineer*, who may devote a part of his time or all his time, depending on the size of the plant, and who must be made responsible for the entire safety program and who should be qualified to work harmoniously with the management, with all foremen, and with all individual workers.

4. *Meeting of operating executives*, at which the plant manager, the general superintendent or other prominent executives should preside and should explain to all operating executives and especially to all the foremen about the accident-prevention program, about the duties of the safety engineer and the safety department, about the benefits expected from the safety program, about the importance of the loss of wages to workmen from accidents; and the kind of coöperation which is expected from everybody.

Safety-bulletin board used at a quarry in Pennsylvania.

5. *Analysis of the plant-accident records*, including an analysis by causes of all plant accidents during the past two or three years, with calculated accident-frequency and severity rates that may be compared with other plants of the community, or with other company plants with which this plant will compete for safety records.

6. *Plant inspections*, usually undertaken by the safety engineer who will be accompanied in each department by the foreman of that department, to help these foremen to prepare individual reports which may be combined as a plant-safety report, to determine the special plant hazards and to prepare for a corrective program to protect all hazardous equipment.

7. *Mechanical safeguarding*, as a follow-up of the plant inspection, making certain that the most serious conditions are corrected first, and making certain that all safeguards are installed in accordance with a uniform plan for the entire plant and in accordance with specifications of the state and insurance company standards.

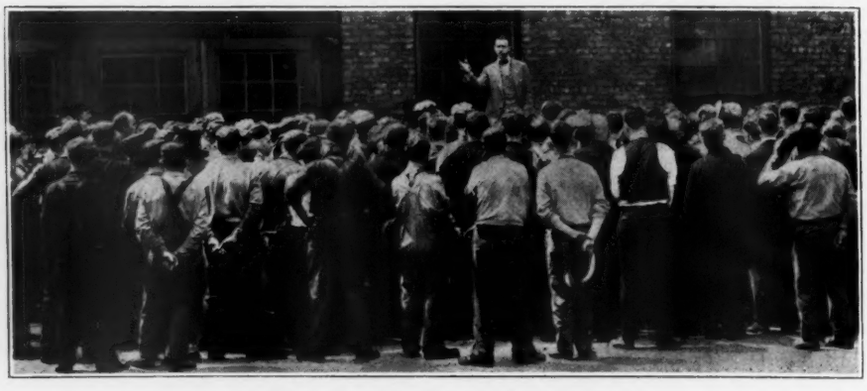
8. *General announcement* to all the workmen of the plant, possibly through personal letters, bulletin-board announcements, plant publications, department meetings, and general mass meetings.

9. *Educational program.*

10. *Engineering revisions.*

The last two of these steps—educational program, and engineering revision—are the two steps which relate most closely to maintaining interest in safety.

Through engineering revision—that is, through a continuous program of plant mechanical improvements and



A safety director addressing a group of workmen.

through the development of equipment and mechanical methods which gradually will approach toward a high degree of mechanical safety—the management can demonstrate to all executives and to all workers that the plant-safety program has been earnestly undertaken.

But the educational program should be closely associated with this mechanical improvement. It is unfortunately true that some companies, after appointing a safety engineer and installing a few safeguards, seem to expect their accidents automatically to decrease in some miraculous manner.

The clock idea is used extensively in promoting safety.

But organizing the safety program and providing mechanical equipment is merely the first step. This first step must be continuously supplemented by safety education.

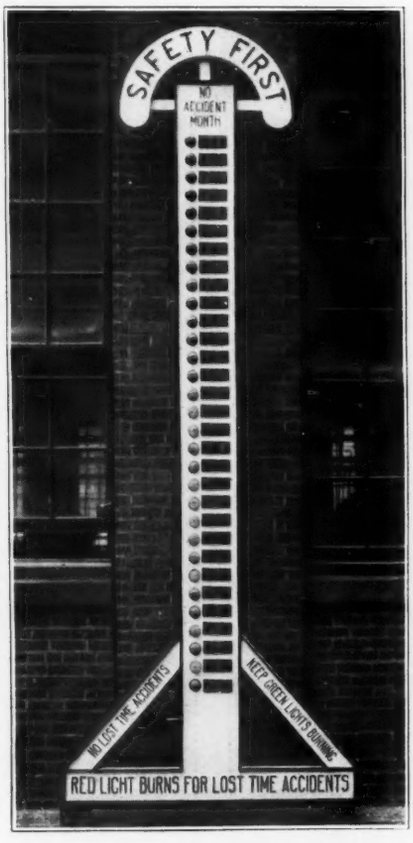
To revive interest in safety activities and to maintain interest, the safety engineer must follow a program of continuous analysis of the accident records of the plant for the purpose of placing special emphasis in the safety program on places and methods which have proved to be the most hazardous. The safety engineer must devise methods for getting his analysis of these hazards into proper form for effective presentation to the management.

The safety engineer also should develop a table of inspection periods for the most hazardous equipment and operations of the plant. Here is a suggested table of inspection periods:

Items	*Interval Between Inspections*
Crane chains and hooks	Constantly
Cranes	Constantly
Elevators	Constantly
Bulletin boards	As bulletins are posted
First-aid cabinets	Weekly
Safety meetings	1 to 3 months
Stair treads and railings	3 months
Goggles; sterilizing outfits	3 months
Tools and equipment (mechanical guarding)	In case of rearrangement of department or plant
Electrical-shop hazards	6 months
Hand trucks	6 months
Ladders, portable and stationary	6 months
Hand tools (mushroom head, broken handles, etc.)	6 months
Emery wheels (guards and water-supply)	6 months
Stretcher cabinets	12 months
Crane operators (physical examination)	12 months
Warning signs	12 months

One of the most effective methods for maintaining the interest of the foremen in the plant-safety program is through special foremen's safety committees, the membership of which may change automatically and quite frequently. In some plants accident costs are recorded by departments and added to the operating costs, so that the foreman's records automatically will reflect his interest and success in preventing accidents. There is a marked trend in this direction in many industries and especially in mining and quarrying. This plan emphasizes in positive manner that the foreman is responsible for the safety of his men, and under this plan the safety director is merely an advisor and helper of the foreman and the safety record of the foreman becomes in reality a part of his efficiency record.

A good many communities, usually through the local safety council or some other body, hold safety schools for foremen, possibly supplemented by special meetings where foremen from neighboring plants can meet in groups and exchange practical ideas and experiences.


SAFETY FIRST
NO ACCIDENT MONTH
NO LOST TIME ACCIDENTS
KEEP GREEN LIGHTS BURNING
RED LIGHT BURNS FOR LOST TIME ACCIDENTS

Another unique method used to further the accident-prevention plan.

There are many practical methods for maintaining the interest of the workers in the plant-safety program. This will depend a great deal on the personnel and location of the plant. Where a plant is one of a group and where this plant is in active competition with other plants for monthly or annual safety records, this competition may be the chief stimulus.

Especial attention always should be given to new employees, to make certain that they are properly introduced to safety work and properly trained by competent persons.

Neat and attractive bulletin boards, properly placed and illuminated, have come to be essential in maintaining the interest of workers in accident prevention. Bulletins and posters should be frequently changed, and opportunity made to use plant photographs and other local materials.

Many plants hold safety mass meetings or departmental meetings at least once a month, with perhaps one-half of the meeting time devoted to entertainment and the remainder to practical and serious safety talks. Many plants develop interest through competing plant teams.

Interest in safety may be stimulated through picnics and other outdoor meetings, where first-aid competitions or special "stunts" are featured and where safety playlets or contests, which feature safety situations or activities, may be provided.

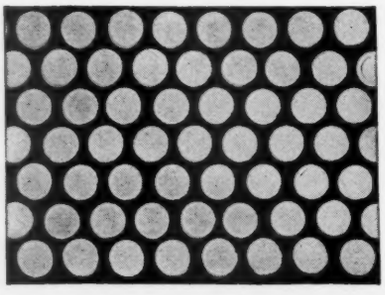
Individual letters about safety signed by the manager always are important, and these may be supplemented by other such printed matter as safety folders, safety slogan slips, safety calendars, and plant-safety publications.

A suggestion box is another good means of developing interest in safety. Many companies offer cash or other prizes for the best safety suggestions with practical efficiency value. Especially in a small community, an effective way to stimulate general interest in safety is through safety instructions to pupils in the public schools, possibly including prizes offered for the best safety essays. Plant-safety committees are essential, and many plants have a "safety court" to investigate all serious accidents and even to recommend penalties when responsibility of the accident can be fixed.

Many companies have rule books with considerable space devoted to safety precautions, and these often are used for new workers.

It may be said in general that the most essential step for maintaining continuous interest in the plant-safety program is for every person in the plant—management, supervising officials, and workers—to be trained to keep in mind that an effective safety program must be a coöperative enterprise in which each person must take an active part.

MORROW SCREEN PLATES



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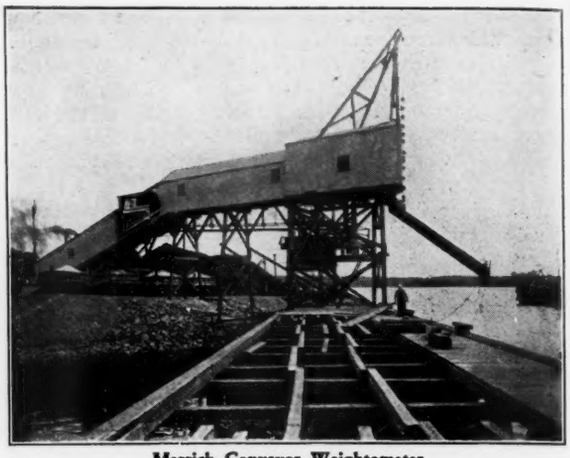

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Weighing Stone to Boats

The Merrick Conveyor WEIGHTOMETER!

Will weigh within a guaranteed accuracy of 99% any material passing over a conveyor upon which it is installed, and doing it without additional handling, expensive labor, or loss of time.
Weightometers are ideal for weighing stone, gravel, sand, coal and hundreds of other conveyor-handled products.
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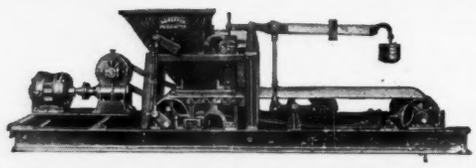

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If you have a mixing problem you would like to handle automatically and accurately it will pay you to investigate SCHAFFER POIDOMETERS.

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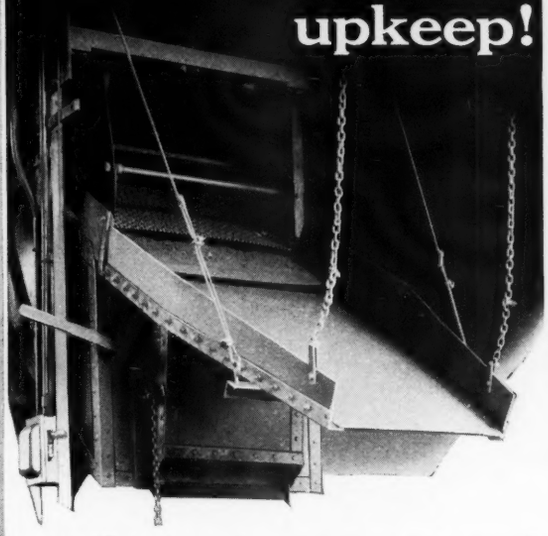
MITCHELL ELECTRIC VIBRATING SCREEN

We urge you to compare

not only tonnage

but

upkeep!



WE invite and urge you to look into the records that the improved Mitchell Screen is making for low maintenance cost.

We urge you to investigate the number of jobs on which Mitchell Screens are replacing others **because** of this low maintenance cost.

The Mitchell Screen's higher speed—3600 vibrations a minute—is setting new records for tonnage per day, every day.

Its famous "triple" action—combining **horizontal, vertical** and **rotary** actions—is solving many difficult screening "problems."

Furthermore, the improved Mitchell is the lowest cost vibrating screen we know of. Lowest **first** cost, lowest **upkeep** cost, and highest production. We urge you to investigate these features.

Write today for information showing **How** and **Why.** Simply fill in and mail the coupon, or clip it to your letterhead. Thank you.

Gifford-Wood Co., Hudson, N. Y.
Send me full information on the Mitchell Electric Vibrating Screen.

Material to be screened .....

Tonnage screened per hour .....

Company .....

Address .....

Position .....

P & Q

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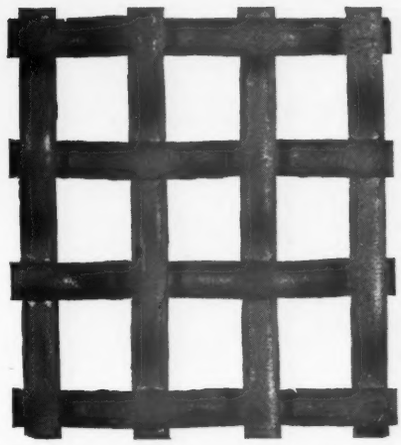
Our Answer To
Your Request For
Economical Screening

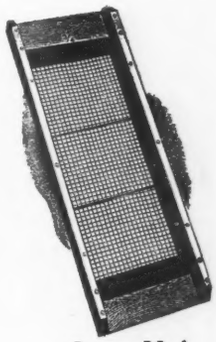
ROK-TEX



Screening stone—that's one of the toughest jobs in all industry. But it is not too tough for ROK-TEX, the sturdy "Buffalo" wire cloth that is tailor-made for severe usage. Actual working tests have proved the life of ROK-TEX 50% to 200% longer than any ordinary screening. Where can you find a better guarantee of longer, more economical performance? ROK-TEX is made in all sizes from ½" space No. 10 to 6" space of ¾" rod.

WIRE CLOTH AND SCREENS FOR ALL PURPOSES

The "Buffalo Wire" line includes cost-cutting wire cloths and screening for every conceivable job in quarry and pit. "Buffalo" Sand and Gravel Screens are made of highest grade wire cloth securely mounted on 26x72 inch pine frames with sheet iron protection at top and bottom to prevent wear at these points.



Square Mesh Sand & Gravel Screen.

Write for quotations and full information.

New No. 10DD Catalog Upon Request

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INCORPORATED
(Formerly Scheeler's Sons, Est. 1869)
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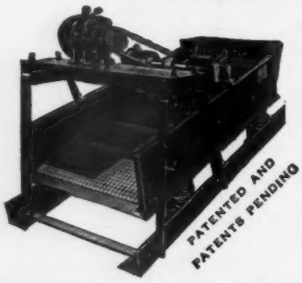
PLAT-O
VIBRATING SCREEN



Produces with high efficiency and accuracy larger tonnages per square foot of effective screening area than any other machine of its kind. Differential conveying action of Plat-O Screen permits operation at very flat angle. Controlled action of screen cloth greatly increases capacity output.

All popular sizes, single, double, and triple deck. Send for our New Bulletin.

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Any handling capacity up to 1,000 tons per hour.

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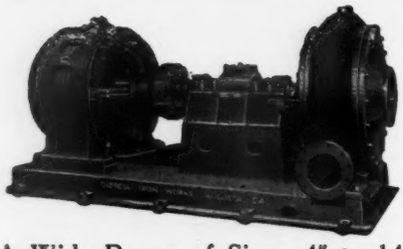
CHICAGO

SAND AND DREDGING PUMPS



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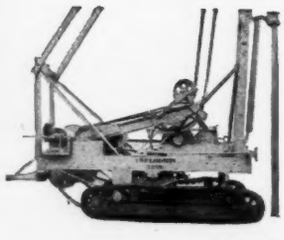

The New Loomis "Clipper" size 44 answers the question with friction clutch operated full length crawlers—simple, durable, accessible. It will climb unusually steep grades and will pay for itself in time saving (which can be devoted to drilling) getting to the jobs that are hard to reach and quick shifting to positions.

Size 44 "Clipper" comes equipped with steel frame, wooden or steel mast, wire or manila line.

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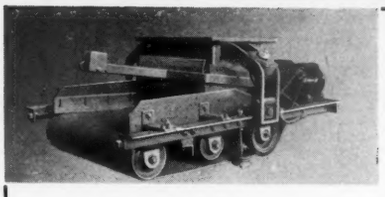

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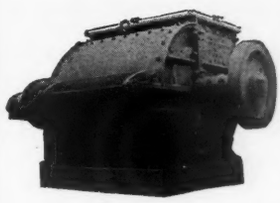

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